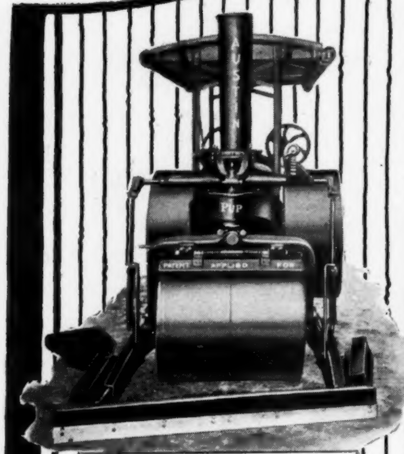
# PUBLIC WORKS

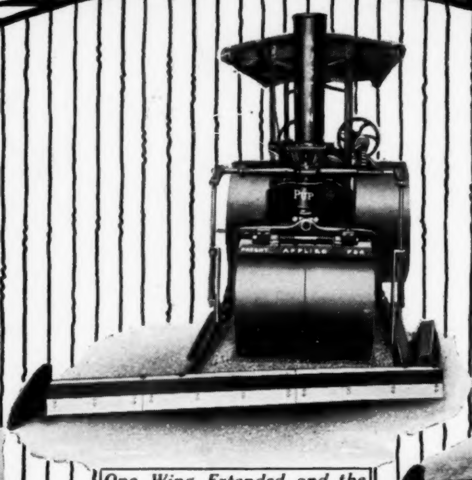
CITY COUNTY STATE



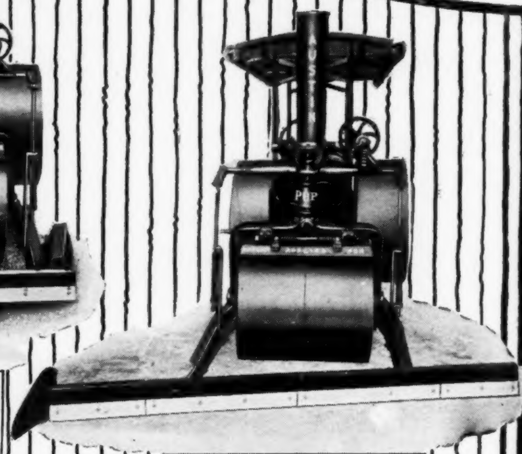
AUGUST, 1923



*Both Wings Swung Back.*
*The Position for Difficult Work*



*One Wing Extended and the Other Swung Back.*
*The Position for Work of Medium Difficulty.*



*Both Wings Extended.*
*The Position for Easy Work*

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# PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 54 August, 1923 No. 8

# Constructing Mitchell Dam

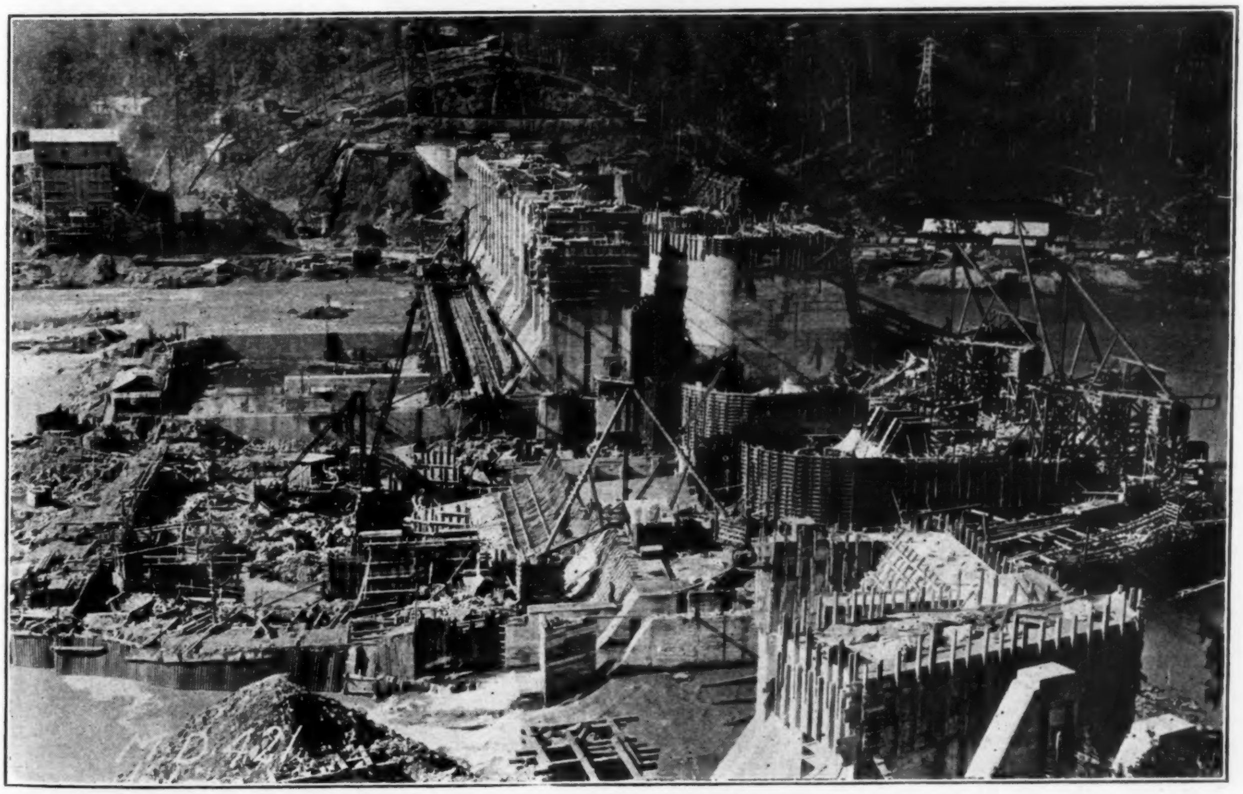
**Construction of cofferdams in a wide, swift stream as preliminary work in development of a power project for the Alabama Power Company**

By L. G. WARREN*

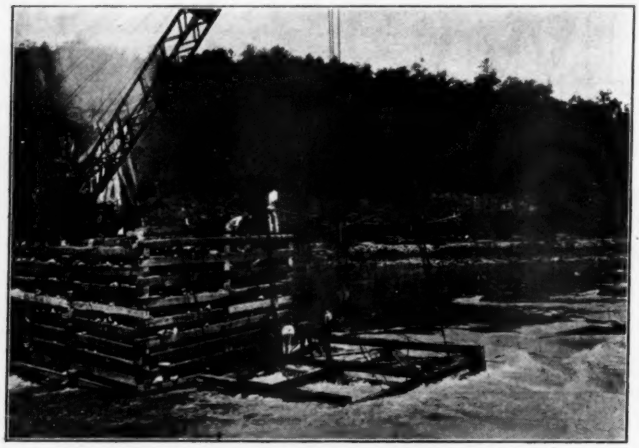
In the May issue of PUBLIC WORKS under the title "Super-Power Electric Systems," PUBLIC WORKS referred to the southern super-power system, which contains more than 600 miles of distribution line and nine generating stations and six main distributing centers. One of the cooperating companies in this system is the Alabama Power Company. This company has hydroelectric generating stations at Jackson Shoals, 3,000 h. p., and one at Lock No. 12, about 60 miles below Birmingham, producing 110,000 h. p.; also reserve steam plants on Warrior river, 77,000 h. p., at Gadsden, 20,000 h. p., and at Birmingham, 15,000 h. p. The company has 1,500 miles of transmission lines feeding the various industries and communities of the state. The main distribution line carries a current of 110,000 volts, which is stepped down to 44,000 volts at the primary sub-stations, which have a total capacity of 300,000 K. V. A.

Owing to the rapidly increasing demands of the Alabama industries for electric power, the company is constructing the Mitchell dam and hydroelectric plant on the Coosa river 12 miles down-stream from Lock 12. Construction on this dam started in July, 1921. Generation of power was started with one 24,000 h. p. gen-

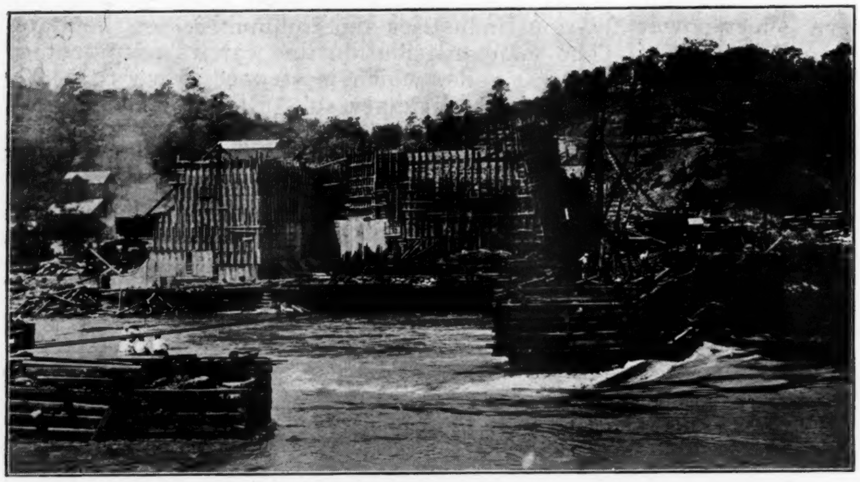
*Principal assistant engineer for Dixie Construction Co.



COFFERDAM NO. 3 ON NOVEMBER 8, 1922.
In left foreground, southeast arm with steel sheeting. Right foreground, river flowing through stream control gap. Forms for bridge deck piers, power houses No. 3 and No. 4 and east abutment.



PLACING CRIB IN NO. 3 COFFERDAM.
Crib has just been deposited in water by crane. Cables suspend it from main cable across river, by which it is lowered (by means of blocks) as crib is built up and loaded.



RIVER ALMOST STOPPED BY COFFERDAM NO. 3.
Northeast arm in left foreground; upstream arm in right foreground. Forms for main body of dam and power houses in background.

erator on April 7 of this year, a second one early in June, and a third generator will probably be started about the middle of July.

The dam is of the gravity type, constructed of cyclopean concrete. The upstream face is straight and the downstream face is an ogee curve. The minimum width at the base is 74 feet 3 inches, and the width at the crest is 8 feet 3 inches. The length of the crest is 1,146 feet between abutments, and the spillway length is 930 feet, and the elevation of spillway is 335, which is 87 feet above the lowest point in the foundation and 70 feet above bed rock at the toe.

Excavation for the dam and the power houses involved 7,800 cubic yards of earth and 63,600 cubic yards of rock. The construction will require approximately 203,000 cubic yards of concrete and about 1,285 tons of reinforcing steel.

There will be four power houses, which will be placed upstream from the dam and form an integral part of it. This design eliminated the necessity of the usual power house building. Each power house rests on a separate foundation. Each will contain an electric generating unit of 24,000 h. p. capacity, the turbines being furnished by the Allis-Chalmers Company and the generators by the General Electric Company. The effective head on the turbines is 70 feet.

The reservoir created by the dam has a capacity of 58,230 million gallons of water, or 175,000 acre-feet. The area of the water surface with a full reservoir is 5,800 acres, and the length is 12 miles, or the entire distance from the dam to the company's hydroelectric plant at Lock No. 12.

Above the spillway extends a bridge carried by piers 35 feet above the spillway crest. This carries standard gauge tracks from the main line railroad on the west bank to the eastern side of power house No. 4. A siding from this track passed under an overhanging reach of a 125-ton steel gantry crane, which has a runway so located that it can handle all equipment in the power house for installation and repairs. Each generator room is covered with a low roof, the center section of which is divided into two movable pieces mounted on trucks and supported on steel frames, the trucks being actuated by

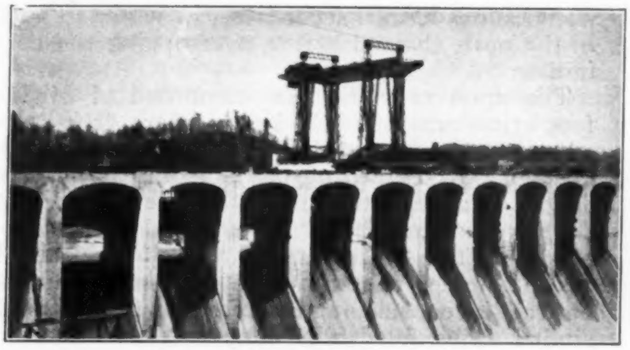
IN FOREGROUND, BEGINNING OF CONSTRUCTION OF DOWNSTREAM ARM OF COFFERDAM NO. 3.
Left background, cofferdam No. 2, forms for spillway section of dam, and steel cable suspension bridge between cofferdams No. 1 and No. 2.

motors. By removing this section of the roof the entire area over a generator unit can be exposed and the gantry crane can pick up any piece of equipment for repairs in place or for removal to the machine shop. This machine shop is adjacent to the west side of power house No. 1. In addition, the gantry crane can be used in raising and lowering penstock gates, trash racks, stop logs, etc.

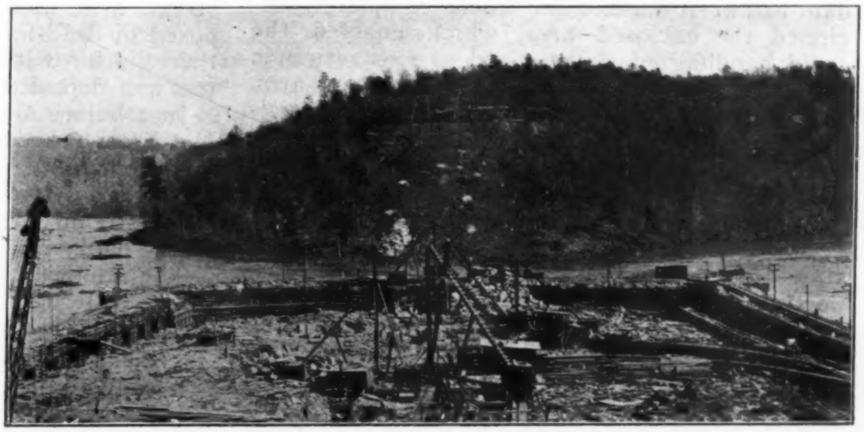
Between the main structures of the power houses and the up-stream face of the dam is a gallery at elevation 360, or 10 feet higher than the top of the flood gates on the dam, and extending from the west end of power house No. 1 to the eastern end of power house No. 4. In this gallery are situated the switchboards, the buss structures and office. The transformers are located on the roof of the operating room.

There are 26 flood or spillway gates of the Tainter type, each 15 feet high and 30 feet wide. They are mounted on end pins or shafts located in the bridge piers and are operated by electric motors, one for each pair of gates, with a clutch between the motor and each gate. It is calculated that these gates will pass the maximum recorded flood of the Coosa river. The bottom edge of the gate is at elevation 335 and the top edge at elevation 350. Six bays or spaces 30 feet long between bridge piers are provided as emergency spillways, four of them on the west end and two of them on the east end of the dam.

One of these spillways has its crest at elevation 355 and the other five at elevation 350.



DOWNSTREAM VIEW, SHOWING TAINTER GATES IN PLACE, AND GANTRY CRANE.



COFFERDAM NO. 3 DE-WATERED. TAIL TOWERS OF CABLEWAY IN BACKGROUND.

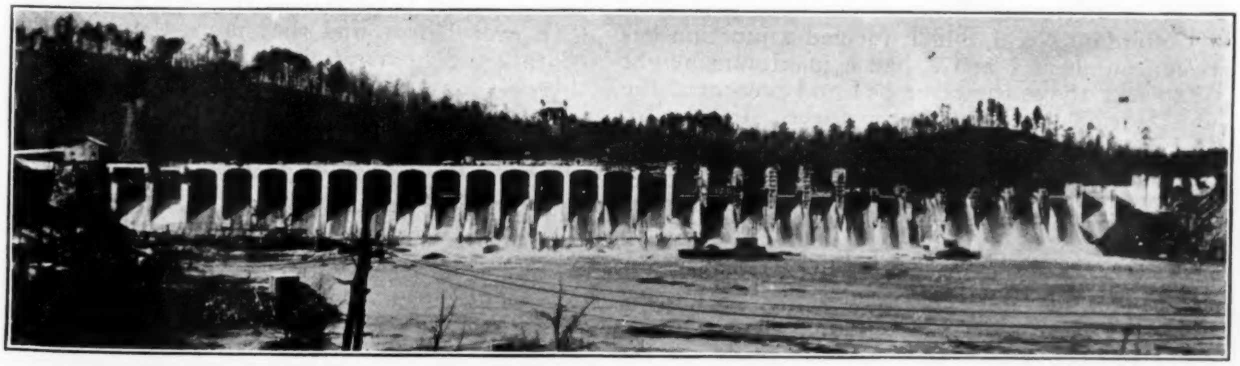
### CONSTRUCTION OF THE DAM

Stream control was a major operation in the construction of the dam and the building of the cofferdams was accordingly one of the most important phases of the work and was started immediately upon the completion of the standard gauge extension from the Louisville & Nashville railroad to the dam, a distance of about eight miles.

The construction of cofferdam No. 1, the laying of narrow gauge tracks and the erection of mixing and crushing plants were begun simultaneously.

At the site of the dam the river is 1,000 feet wide. The general scheme of cofferdams was to divide the work into three sections—the western side of the river or cofferdam No. 1, the eastern side or cofferdam No. 2 and the middle or closure section or cofferdam No. 3.

Cofferdam No. 1 extended 550 feet into the river. The three arms of the dam enclosed an area 600 feet long and 400 feet wide, or about 5 acres. In this was located the excavation for two of the power houses as well as for the western section of the dam. The up-stream arm of the cofferdam was carried to elevation 290. This



VIEW FROM DOWN STREAM, SPILLWAY COMPLETED, BRIDGE DECK ABOUT HALF COMPLETED.

would allow 108,000 second-feet of water to flow in the open channel before overtopping the cofferdam.

The up-stream arm was composed of 24x24-foot cribs built of 10x10-inch timbers drift-bolted together. These cribs were filled with rock and double-sheathed on the exterior. Clay was deposited against the crib as a water seal. The down-stream arm was 16 feet wide and composed of two chambers—a line of rock-filled cribs 8x8 feet constructed of 8x8-inch timbers on the inner side, and the outer chamber of similar cribs filled with clay, with a clay toe on the exterior. The connecting or out-stream arm consisted of two lines of 12x12-foot rock-filled cribs separated by a clay chamber 6 feet wide for water seal. The exterior of this arm was sheathed with 2-inch timber.

For handling the timbers to the cofferdam, narrow gauge flat cars pulled by electric locomotives were employed, the track being laid on the cofferdam and maintained in close proximity to the timber-laying gangs. When the cofferdam had been finished the tracks completely encircled the enclosed area, which enabled the rapid handling of timbers and of excavation in the subsequent work. On the out-stream arm, timbers were handled to position with a travelling derrick, motor-driven, with a 35-foot boom. Pneumatic boring machines prepared holes for the drift bolts.

Eight months after beginning cofferdam No. 1, construction was started on No. 2. By this time two cableways were available for transporting timber and other material. This cofferdam was the smallest of the three, enclosing only 1/3 of an acre, being 136 feet long and 104 feet wide.

The up-stream and down-stream arms of this coffer were composed of 8x8-inch timber rock-filled and sheathed with 2-inch planks on the exterior with a clay toe deposited against it. The out-stream arm consisted of two chambers, one being built of 10x10-foot cribs using 8x8-inch timbers, sheathed on both sides with 2-inch lumber and rock-filled, while a clay chamber was constructed by means of a timber frame bolted to these cribs, which was filled with clay to act as a water seal. The construction of this coffer left a channel capable of passing 65,000 second-feet before flooding the coffers, this channel being 28 feet deep at the up-stream arms of the cofferdams.

Cofferdam No. 3, which formed a junction between numbers 1 and 2, had a maximum height of 40 feet above the river bed and presented the most serious problem of the three. It was 270 feet long and 330 feet wide, enclosing 2.9 acres. Two of the power houses as well as the center section of the dam were located in this area. The up-stream arm was carried to elevation 300 and had a maximum width of 36 feet. It was composed of rock-filled cribs 24 feet long by 36 feet wide, built of 12x12-inch timbers. On the exterior, U. S. steel sheet piling was driven to the river bed and a clay fill was made on the exterior of the sheeting to act as a water seal. The construction of this arm in the swift and deep water was a difficult task, but was handled in a novel manner. The first crib adjacent to cofferdam No. 1 was built in the usual manner, loading it with rock at intervals. A ¾-inch plow-steel cable was then suspended from an A-frame on this first crib to the opposite shore. The succeeding cribs were started on the first crib and lifted and supported in position in the water by a locomotive crane, and cables from blocks on the ¾-inch steel cable held the cribs at the proper alignment during the building of subsequent courses of timbers. The northeast arm of cofferdam No. 3 was a continuation of the out-stream arm of dam No. 2 and consisted of two lines of 16x16-foot rock-filled cribs of 12x12-inch timbers with a clay chamber 10 feet wide separating the lines of cribs and serving as a water seal. A clay fill was placed on the exterior also of this arm. The southeast arm was formed by a single line of 12x24-foot rock-filled cribs with U. S. steel sheet piling driven to river bottom along the exterior. The down-stream arm, with top elevation of 285, was composed of 8x12-foot rock-filled cribs sheathed on the exterior with lumber, against which a clay toe was deposited.

Just before the up-stream arm of cofferdam No. 3 was closed, stream control passages 12 feet wide in cofferdam No. 1 were opened, allowing the river to flow through them and through the eight stream control passages in the west half of the dam, which had already been constructed.

The removal of the timbers and rock and clay fill in cofferdam No. 1 was done with an Erie steam shovel, type 8, caterpillar traction, using a ½-cubic yard bucket.

This dam was built by the Dixie Construction Company. O. G. Thurlow was chief engineer for the Alabama Power Company and the Dixie Construction Company, L. V. Branch was resident engineer and H. L. Myer was construction superintendent for the Dixie Construction Company, of which the writer was principal assistant engineer.

## Power for Electric Public Utilities

Information has recently been made public by the Geological Survey concerning the use of fuel in producing electricity during the past four years. The figures given show that public utility power plants produced more electricity in 1922 than ever before and that more than one-third of this was generated at water power plants, thereby conserving over 20,000,000 tons of coal. One-fifth of the total amount of electricity produced by water power in the United States is produced by the California hydro-electric plants.

## Pennsylvania's Highway Program

The Pennsylvania State Department of Highways announces that its construction program for 1923-1924 includes building 275 miles of durable highway, which will exhaust all funds available for construction purposes unless the

voters in November authorize a $50,000,000 bond issue. The amount otherwise available, including $5,000,000 Federal aid, $4,000,000 motor license fund, is about $15,000,000. It is not considered desirable, however, to use the motor license fund for anything but maintenance.

Construction will be confined to primary highways, selected after a careful study of the relative needs and merits of the individual cases, including results of traffic surveys. Naturally, many will be disappointed by the omission of certain roads from the program, but "no change will be made in the program as now announced by the Department."

## Automobile Costs in St. Louis

Purchase money and the gasoline bills are not the only expenses that automobiles run up against city governments. At the council meeting on June 26 of St. Louis, Missouri, ordinances were passed appropriating money for paying damages to a woman run over by an automobile belonging to the police department, an employee of the city who broke his wrist cranking a city truck, and a private automobilist who ran over a bank which was not protected by warning signs.

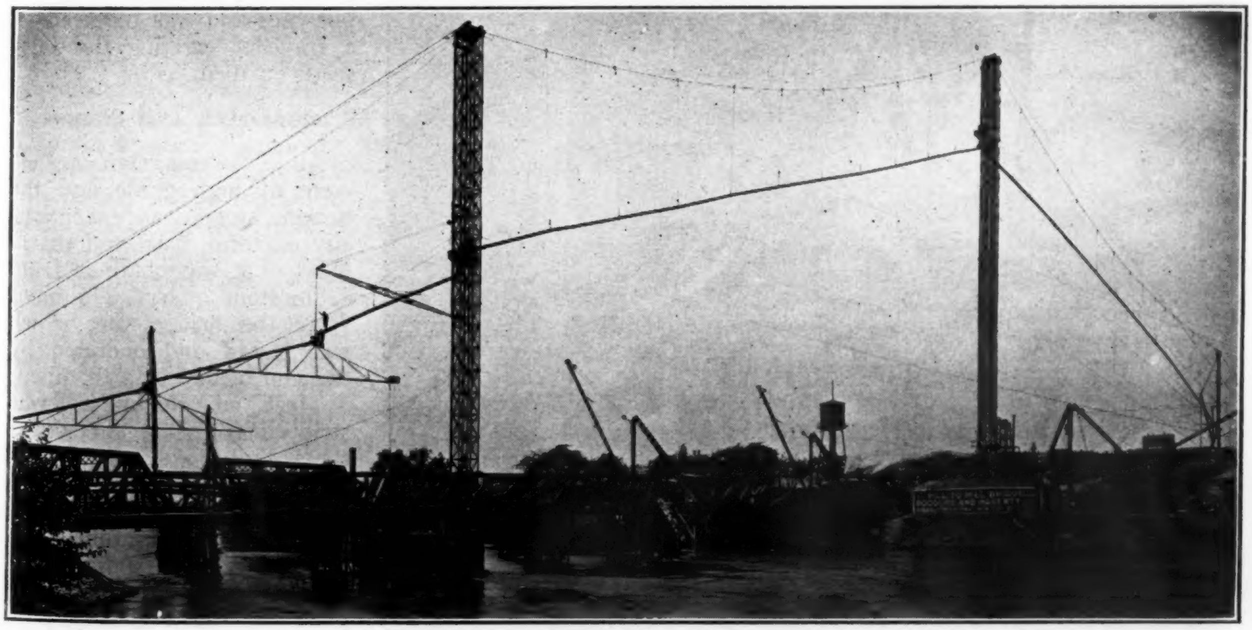
The fourth damage for which the city paid was incurred in a most unusual way. To quote from the ordinance: "On or about February 5, 1923, John Tayon was crossing the Compton Avenue viaduct from the north in his automobile and he had gotten a little more than half-way across when the blocks in said roadbed, due to expansion, rose up under said machine, causing the same to swerve and turn over; and by reason of said accident the machine of the said John Tayon was damaged in the amount of $64.75."

# Hill-to-Hill Bridge

**Description of operations employed in constructing a viaduct the design of which was described in the July issue. Deep foundations encountered great quantities of water. Construction equipment costing $300,000 includes two concrete mixing plants and hoisting towers and chutes.**

By Frank W. Skinner

Work on the substructure was commenced in September, 1921, with the excavation for the pier foundations, which were carried through an average depth of about 10 feet of loam, 10 or 15 feet of gravel, and the remainder of the distance through disintegrated rock. About three-fourths of the material was removed by 1-yard orange-peel buckets operated by stiff-leg derricks with 60-foot booms set to command the whole area of each excavation. The spoil was delivered to 5-yard motor trucks and stored to use for backfill and to fill in between the spandrel walls of the bridge. The average haul was about ½-mile to a spoil bank located on a 5-acre lot rented on Sand Island, where it was piled to a height of about 30 feet and was reclaimed by a ⅞-yard steam shovel that loaded it into 38 x 11-foot wooden scale pans 20 inches deep that were hauled to the bridge, hoisted by traveling derricks with heavy steel I-beam sills



HOISTING AND DISTRIBUTING TOWERS CONNECTED BY SUSPENDED CHUTE SERVING ONE OF TWO DUPLICATE MIXING PLANTS

on tracks on the tops of the finished spandrel walls. The material was dumped in position, levelled in 12-inch layers, thoroughly wet down with a hose and tamped by ten-man gangs who handled about 250 yards per day.

### COFFERDAMS

The gravel bed was thoroughly saturated with ground water, which flowed in great quantities into the deeper excavations, about one-half of which were sheeted with 14-inch arch-web Lackawanna steel sheet piles from 40 to 45 feet long, which were set up to make complete cofferdams of 35 x 75-feet maximum dimensions and were driven two or three feet at a time successively by steam hammers, suspended from derrick booms.

The excavation was carried on simultaneously with the pile driving and great care was taken to undermine and remove interfering boulders. Whenever the latter were encountered, driving was omitted at that point until the boulder was removed so that the piles were with little injury driven down at a rate equivalent to 10 to 20 piles per day. Considerable handwork was required for the excavation and was always necessary while removing the last two feet at the bottom and for cleaning and preparing the surface of the rock.

The material excavated from the river cofferdams was dumped outside to form an embankment which protected the cofferdam and provided fine material that filtered into the pile joints making them very tight so that there was practically no leakage, except through the bottom of the pit where the water boiled up in great quantities and was removed by two 8-inch and one 6-inch centrifugal electrically driven pumps, of which one was generally in reserve.

The contractor was required to make the excavation large enough to afford a clearance of two feet around all sides of the pier to provide for final inspection of the concrete—a feature that was omitted at the last pier after all of the first had been found entirely acceptable, developing no faults when inspected.

The piles, which had a penetration of about 30 feet, were pulled at the rate of twenty per day by the McKiernan-Terry hammer which drove them and were reclaimed in good condition suitable for repeated use. Before pulling them, the embankment that had been placed around the exterior of the river cofferdam was dredged up and deposited inside the cofferdam for backfill around the piers.

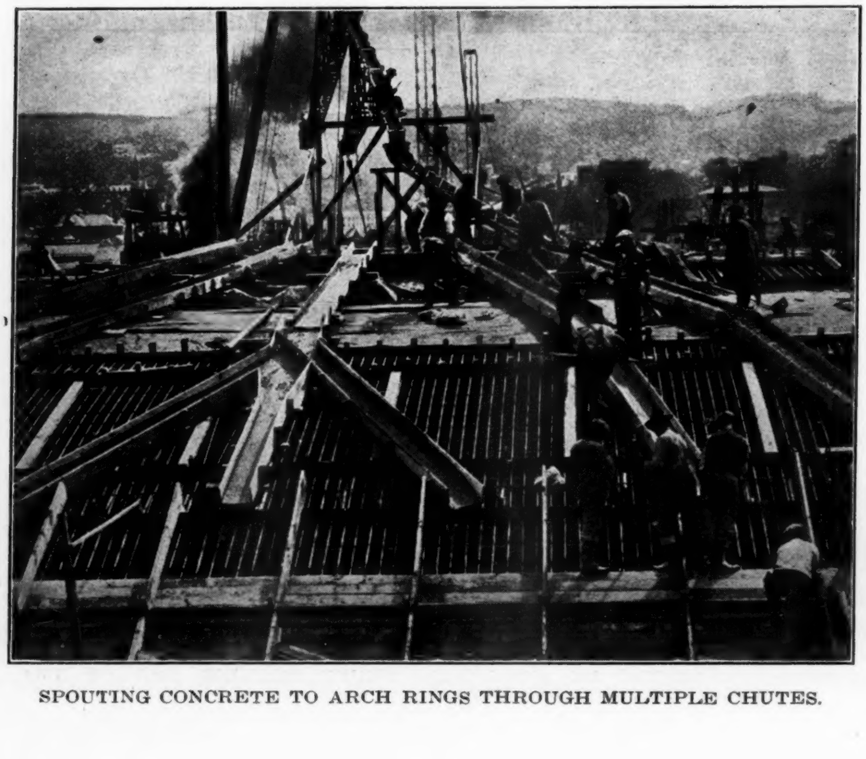
### FOUNDATION PILES

The concrete piles for the foundation of Pier 2 were provided with castiron points and were driven by a steam hammer weighing 7,000 pounds and striking about 60 blows per minute on a cushion which endured for about two hours of steady driving.

The piles usually penetrated the first 15 feet in about 15 minutes and then, when they went down continuously without encountering special obstacles, penetrated at the rate of about 1 foot for 300 blows and were driven to a refusal of 50 blows for the last half-inch penetration. About 25 per cent of the piles penetrated the full distance without special interruption from encountering obstacles. When obstacles were encountered, a refusal of 100 blows for the last ½-inch penetration was required.

The tops of the piles were cut off when necessary, as was the case in most instances, by a pneumatic hammer scoring a channel around the four sides and exposing the reinforcement rods which were cut through with an oxy-acetylene flame, after which the core was easily wedged off, the work being done by two men at an average rate of about 3 hours per pile.

The wooden pile foundation for the steel viaduct and the pile foundations for the arch centerings for the river spans required about 750 piles from 30 to 35 feet long, which were driven by steam hammers suspended from the boom of a traveling derrick that set the pile caps and was followed by a traveller erecting the false work on them.



SPOUTING CONCRETE TO ARCH RINGS THROUGH MULTIPLE CHUTES.

### AGGREGATE AND CEMENT

All of the concrete materials were of high grade and the broken stone was exceptionally uniform, hard and sharp. Most of it was obtained from a limestone quarry, 1½ miles from the bridge site, which was leased and operated by the contractor. Earth, about 3 feet in thickness, was stripped from the surface of the rock by a scraper and a vertical face 60 feet high and 200 feet long was operated with a level floor from 40 to 100 feet wide. The dip of the strata inclined about 60 degrees to the horizontal and the strata were from 1 to 4 feet thick. Full depth holes,

179-FOOT SPANS 1-2 AND 8-9

6 inches in diameter and 15 feet apart in both directions, were drilled to a maximum depth of 70 feet and charged with 60 per cent dynamite. A blast consisting of 16 holes produced about 18,000 tons of rock ready for the crusher. The rock was broken by the initial blast, small enough to be handled by a 1-yard steam shovel that loaded skips, was hauled up a 250-foot incline and dumped into the 24 x 36-inch jaws of a Bulldog rock crusher, from which it was elevated to a scalping screen and the rejects passed through a No. 6 and a No. 3 gyratory crusher. The screenings were sold to a manufacturer of concrete bricks and the broken stone was delivered to the bridge site by 5-ton automobile trucks that dumped into two storage bins each of 600 tons capacity. Except the steam shovel, all of the quarry plant was operated by electricity and required a force of 28 men.

Sand was delivered by rail and stored in two 300-ton bins adjacent to the stone bins, one of each being near each of the two concrete mixing and hoisting plants.

Cement was hauled 12 miles from the Pennsylvania Cement Company's mills at Bath, Pa., in 5-ton automobile trucks, and was stored in two houses, each of 7,000 bags capacity.

CONCRETE PLANTS

At each concrete plant there were two 1-yard mixers supplied by gravity from a receiving hopper that was filled with stone and sand by a 1⅝-yard orange-peel bucket, operated by a 75-foot derrick boom. The aggregate and cement were placed in a 1-yard measuring box with horizontal marks to show the different levels for sand and stone for 1:3:5 mix. When other proportions of concrete were required, core boxes, each of 1-cubic-foot capacity, were nailed inside the measuring box until the required volumes were procured, thus providing for quick changes and accurate measurement for the various classes of construction.

The concrete mixers were operated at 20 revolutions per minute and were set with locked mechanism to run at least 2 minutes and were provided with an accurately measured quantity of water which varied in amount according to the instructions of the inspecting engineer.

The mixers were located about 1000 feet apart so as to command all of the main structure between them and for about 700 feet radius on each side. Beyond these points the concrete for the ramps and main bridge was delivered in buckets hauled on service tracks, or in some cases delivered to trucks and unloaded into elevated receiving hoppers, from which it was spouted a short distance to required position. The receiving hoppers were shifted from place to place as required, until all of the concrete within the radius of their chute had been deposited.

Adjacent to each mixer there was a steel hoisting tower, one of them 240 feet and the other 200 feet high. About 350 feet from the 200-foot tower there was erected in the river a 160-foot auxiliary tower carrying a boom with two suspended cantilever trusses. Steel cables, from the tops of the hoisting towers to the mast and auxiliary tower, supported steel chutes delivering to chutes on the cantilever trusses, thus providing a long radius of distribution.

*(To be continued)*

# Redressed Granite Block in Philadelphia

Of about $6,000,000 worth of paving work completed in Philadelphia last year, the unprecedented use of redressed granite block was said by Julius Adler, deputy chief of highways, to have easily been the outstanding feature. Of 39 miles of repaving completed in 1921, approximately 27 miles was redressed granite block, and approximately the same amount and proportion held good in 1922.

Some changes in the specifications for this work have been made during the past few years. For example, in some of the earlier work the contractor was required to make good any deficiencies in granite blocks which might exist at the end of a contract, which requirement was open to the criticism that none but the most experienced could make even an approximate estimate as to what this shortage was likely to be. On later contracts the city has undertaken to supply any deficiencies in blocks that might arise, the contractor hauling them from specified points, and this limited the uncertain element of the contract to the cost of hauling . The 1922 contracts provided for payment of the cost of hauling as well.

With these uncertainties eliminated, the greatest one remaining was variation in the quality and character of the old block in the street. It has not yet been found possible to so draw the specifications as to make the work of redressing granite blocks identical on any two jobs. The reason for this is that the blocks have been obtained from various localities and quarries and have been in service for periods varying from 10 to 40 years, some on heavily traveled streets and others on residential streets. As the specifications described a uniform product to be obtained from these non-uniform blocks, the work required on one job may be much greater than that on another. Block which has cobbled badly under wear requires more labor in dressing, more replacements under inspection and more grout because the joints are more open. For this reason contractors bidding on this class of work should carefully examine the character and condition of the existing old blocks in the street to be repaved.

In general, the city expects to obtain from each class of block pavement a pavement of redressed block that will meet standard specifications. Occasionally, however, it is found impossible, after a thorough trial with skilled dressers, to produce the specified block of approximate rectangular shape rather than lose the potential value which the city has in the old blocks and be required to furnish new ones, a treatment of the blocks is then agreed upon which will produce the best possible block with the destruction of the least number.

Another feature in which more or less latitude is necessary is in the depth of block, this latitude being permitted with a view to reducing waste of blocks and unnecessary labor in cutting them. Measurements made on a number of streets in the city have shown that the old blocks may vary from 9 to 14 inches in length and frequently more within a single city block. The specifications provide for one-inch permissible variation in the depth of the redressed blocks, which correspond to two inches in the length of the whole blocks. It is readily seen that blocks with irregular depth will not preserve an even surface under the pounding of heavy traffic on a sand-cement bed which has not set up, where a mastic or soft filler is used, and the same is true if a cement grout filler is used except that the blocks, instead of gradually assuming an irregular surface as the filler softens, are punched down by the heavy traffic as the grout filler is shattered. This disadvantage of unequal depth must be balanced against the additional cost or impractibility of securing uniform depth from the old blocks and a practical average struck between them.

# Cleaning Sewer Mains

**Methods and appliances used by the city engineers of cities in eight states, results obtained, cost, and other details, described by them especially for this symposium.**

Learning from the questionnaires submitted to city engineers during June that a number of them were using mechanical appliances of different kinds for cleaning sewers, we wrote to such engineers asking that they inform us further concerning their methods and results of using such equipment, giving details in as much fullness as their records permitted. Replies have been received from a few, some using one type of equipment and some another, and all finding much advantage in each of them under conditions suitable to it. W. P. Cottingham, city engineer of Gary, Indiana, describes the use of the Kuhlman sewer cleaning apparatus; S. Cameron Corson, who is borough engineer of Norristown, Pa., describes the use of the Stewart sewer cleaning machine; Ivan E. Houk, city engineer of Dayton, Ohio, describes very fully the use of the turbine cleaning machine, which also is used by G. H. Randall, city engineer of Oshkosh, Wis.; while use of the Victory self-propelling nozzle is described briefly by G. H. Atchley, city engineer of Tucson, Ariz., L. S. Thorpe, city engineer of Bozman, Mont., George A. Carpenter, city engineer of Pawtucket, R. I., R. M. Evans, city engineer of Clairton, Pa., and R. M. Fulweiler, city engineer of Beaumont, Tex.

With the abundance of information furnished by these engineers it has been necessary to condense some of their descriptions, but in doing so we have endeavored to retain all of the important facts communicated by them and bearing directly upon this subject.

## Sewer Cleaning in Norristown

By S. Cameron Corson*

For many years our only method of sewer cleaning was by the use of rods screwed together. At times the workmen would lose these rods by turning them in the wrong direction and a rod is now used with a lock joint which is a great improvement. These joints will stand any pressure or twisting, but the wood from which they are made must be absolutely free from knots or flaws.

The following appliances are used by the sewer cleaning gang: 400 feet of rods with improved lock joint and special attachments such as a claw for entangling rags or other materials, a spade for cutting roots or materials attached to the sewer, a spiral screw 4 or 5 inches in diameter and 6 to 8 inches long to bore into substances for drawing them out, and a spear for making a hole through a bunch of roots or other materials that obstruct the sewer. When a spear has been forced through the obstruction to the next manhole a cable is attached to the last rod and drawn through and up to the street. A windlass is placed over each of the two manholes carrying a cable sufficiently long to reach the other manhole, and by means of these a series of buckets of diameters varying from 8 inches to 15 inches, with knife-like edges front

*Borough Engineer, Norristown, Pa.

and rear, are drawn through the sewer. These cut off the roots at the top and bottom and they enter the bucket through the shutter in the front of it. Dirt, sand and other materials also are picked up by the bucket, the shutter being closed when the bucket is drawn back. To facilitate thorough cleaning we have a line of hose connected to the nearest fire hydrant carrying a small stream into the sewer. This operation requires two men at the top of each manhole and one at the bottom of the manhole to which the bucket is drawn when being removed. An auxiliary windlass with a line attached is stationed at this manhole and the bucket is raised to the surface by this means. The machine used by us is known as the Stewart sewer cleaning machine.

At the completion of the operation, to insure ourselves that the sewer is clean, particularly along the top of the pipe, a ray of sunlight is thrown through the sewer by the use of mirrors from either end.

The men in the sewer cleaning gang receive wages varying from 60 to 45 cents per hour and the cart 75 cents, a total of about $3.25 per hour. A sewer clogged for a distance of from 10 to 50 feet can be cleaned thoroughly in about five hours elapsed time at a cost of $16.25, or an average length of 30 feet at about 50 or 55 cents a foot. It sometimes happens that all of that time will be required and even more to clean out one obstruction 8 or 10 feet long. The amount of material removed varies from a few cubic feet to a full cart load or more. We have raised two root masses 8 and 10 feet long respectively and nearly the full diameter of the pipe. In every case, however, there has been an open space on the flow line of the pipe.

The amount of material removed is not known, as we rarely keep an account of it, but we do examine it thoroughly to ascertain the cause of the clogging in order to prevent a recurrence, if from house wastes, etc. If tree roots cause the stoppage, however, there is no remedy but to cut down the trees. In my experience the worst enemies to sewers are North Carolina poplars, swamp willows and like trees whose roots require a great deal of moisture. In some cases sewers have been clogged so completely that it was necessary to dig down to them and break out a section, and in such cases we have found dense masses of roots which had grown from a tiny root that had penetrated a very small crack in the cement joint.

Manholes on sewers should not be over 200 feet apart, as even at that distance it is difficult for a good strong man to force the rods through the obstruction.

A complete outfit should be used in every municipality. The usual cost is from $1,500 to $1,800 and if a cutting machine is desired it will cost $500 more. We have saved enough in one year to pay for our machine, with some to spare. Before we purchased the outfit, men cleaning by hand rodding often consumed from several days to a week to clean an obstruction 10 to 50 feet long, which now requires only a few hours.

# Cleaning Sewers in Gary, Indiana

**By W. P. Cottingham, City Engineer**

A large part of Gary's 90 miles of sewers, which operate on the combined system and range in size from 96 inches to 10 inches, must be cleaned at more or less regular intervals. This condition arises from the fact that a considerable part of the sewers were laid in water-bearing sand when speedy construction was demanded and there was little realization of the necessity for tight joints. Sizes below 30 inches are made of vitrified clay pipe.

The material removed is mostly sand, which has no objectionable odor and is deposited in fills without creating a nuisance. The removal is accomplished by the Kuhlman sewer cleaning apparatus. It has been found that the sand does

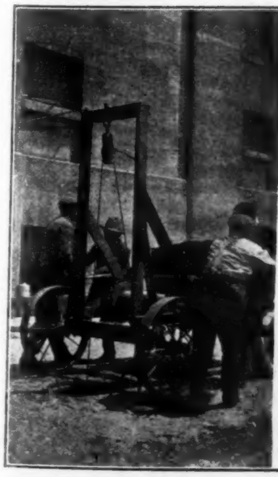


Fig. 1—Portable windlass.


Fig. 2—"A" frame rig.

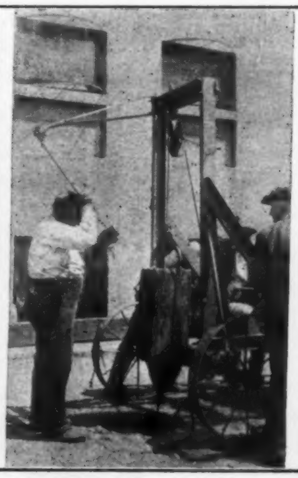


Fig. 3—Loaded bucket rising from manhole.

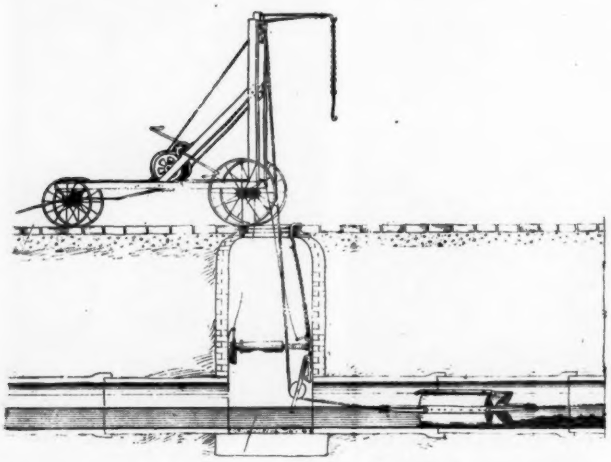

Fig. 4—Discharging load.

SEWER CLEANING AT GARY, INDIANA.

not carry any considerable distance after entering the sewers, except during storm flows. Therefore the greater amount of sand is removed from the lateral sewers unless it has been flushed to the main sewer by use of flushing nozzles connected to fire hydrants. The present practice is along this latter line and the results appear to be most satisfactory. At the end of this season a statement of comparative costs will indicate which method is most economical and which best prevents excessive accumulation of sand in the sewers at points where stoppage may occur unless removed.

Two outfits are employed, each gang using a complete setup of sewer-cleaning apparatus, which consists of two windlass riggings with cable, buckets and manhole jacks of special design to carry the cable into the sewer. The photograph shows two machines working on a 48-inch main sewer with manholes spaced 330 feet apart. The A frame rigging shown in Fig. 2 can be used to good advantage when it is necessary to work several days at one setup, but is not convenient for use on the smaller sewers where it is necessary to move two or three times each week.

The first step in cleaning a sewer is to float a line through or shove a sewer rod through, by which a cable is drawn from one manhole to another. A bucket is hooked between cables from the windlasses at the two manholes, this bucket being made of steel plates and equipped with hinged jaws which are operated by two side plates controlled by a bail hinged at each end. These two end bails also serve to expand the bucket while it is being emptied of its load. The jaws of the bucket are the cutting edges and are closed when the pull on the bucket is reversed. The manhole jack, which guides the cable into the sewer, is an essential feature and insures quick manipulation of the buckets into and out of the sewer. It consists of a yoke with ball joint adjusting screws with a wedge connection on the opposite end, and a trolley arm with cable wheel pivoted at the yoke extending downward and guiding the cable while the bucket is in the sewer. When the bucket is being removed from the sewer it strikes this arm, which swings upward and guides the bucket to the center of the manhole and prevents it striking against the junction of the manhole and the sewer.



SEWER-CLEANING APPARATUS USED AT GARY, IND.

When the bucket is drawn into the sewer by windlass, the tension on the cable indicates when a load has been obtained and the pull is then reversed and the bucket withdrawn. By taking the load off the hinged bail, the jaws open and the bucket discharges its load. Various sizes of buckets are used, a 6-inch being usually used to start operations in a 12-inch line, with an 8-inch bucket for finishing. As the work progresses the bucket is passed full length of the sewer in each direction, picking up a full load each way.

Four men make up a gang on lateral sewers and will clean a section, move, and make the next setup in from a day and a half to two days. On the larger sewers—42-inch to 84-inch—an 8-man gang is used, pulling buckets of 12 inches diameter carrying approximately 1¾-cubic feet. During the past few months such a gang has spent from 20 to 25 days cleaning a section, removing approximately 50 cubic yards of sand from 330 feet of sewer. The accompanying photographs were taken on this work four days after starting.

The cost per foot of such work is not obtainable for the reason that comparative figures were not considered essential during the past few years. The total cost last year to the city of Gary for sewer-cleaning operations amounted to $12,000, some of which was for cleaning catch-basins and gutter inlets, some for flushing sewers, and the larger portion for the continuous operation of the gangs with the machines.

In practice, a gang starts at the upstream end of a lateral sewer and if inspection shows a small deposit, they will flush a section or two using a bag dam in a manhole to collect the sand. When a section is found showing a considerable sand deposit, the machine is used. Very often this will be in a section where the repair gang had previously found and repaired some leaky joints. Each section between this one and the main sewer will be cleaned out in turn. Some of the lateral sewers require such cleaning twice a year, some every two years. The main sewer in the district affected requires cleaning every year.

### Cleaning in Oshkosh

The city engineer of Oshkosh, Wisconsin, G. H. Randall, informs us that that city uses the "Turbine" sewer cleaner, which "cost $1,500 a few years ago and saved us twice that in one season. The cost of operation is difficult to state, as it might depend on the size of the sewer, the amount of matter, the length of time since the previous cleaning and other factors. Three or four men can operate it, this including getting the rods and cables into the sewer. They can clean about two blocks or 800 feet in one day if the pipe is not larger than 15 inches. A 24-inch sewer that was two-thirds full of mud,

gravel and roots was cleaned for a length of 400 feet in two days. This sewer would in a short time have been in such a condition that it would have been necessary to take it up and repair it at a cost of several thousand dollars." Mr. Randall has also found the Petersen hydraulic flusher "a very good cleaner for a very small sum of money."

### Other Reports

*Pawtucket, Rhode Island*—George A. Carpenter, city engineer, writes that his city employs a maintenance gang with a light Ford truck containing the equipment, which is at work practically all the time. They use jointed rods, a Victory self-propelling nozzle on the end of a hose line attached to a hydrant, and a Stewart cleaning machine. "We find all these effective in the particular work for which they are adapted. We find that the Victory self-propelling nozzle will cut its way through catch-basin connections that have become filled with sand and gravel, where the jointed rod would be of no use."

*Clairton, Pennsylvania*—The only apparatus used is a self-propelling nozzle working with 70 to 90 pounds water pressure, and the ordinary 3-foot extension rods. There have been few obstructions. Three men are used, common laborers at about 30 cents an hour. One or two of the jobs have required two or three days, but usually the sewer has been opened in an hour or two. The sewers in Clairton are largely combined sewers of sizes ample to carry away flood water, excepting at one or two locations.

*Beaumont, Texas*—The topography of Beaumont is very flat and most of the sewers are laid on a grade of .2 of 1 per cent., while in exceptional cases 8-inch pipe has been laid on .15 and .10 per cent. Flush tanks are not used. The stoppages are in nearly all cases due to rags or other foreign matters. Our informant, City Engineer R. M. Fulweiler, states that these grades are known to be flatter than the best engineering practice, but stoppages in them are found to be due either to the breaking of the pipes under streets carrying tracks or roots of trees where the pipes were improperly laid, or to rags or sticks which will cause stoppage on almost any grade.

In cleaning the sewers, the city uses a self-propelling nozzle attached to a 2½-inch fire hose with 40 pounds water pressure, which will travel for a distance of 300 feet in a sewer of from 6 to 12 inches diameter and clean it thoroughly of silt or sediment. This is attached to second-hand fire hose carried on a hose reel and is handled by one of the ditching crews, "as it takes more than our two men in the sewer force to handle this hose out of the way of traffic." The city has little occastion for using the apparatus, however.

Last year there were six or eight bad stoppages which necessitated digging up the sewer. In each case stoppage was in a connection from a catch-basin into a combined sewer in which a piece of wood or of carpet or some other foreign matter had lodged. In one instance a block of wood 2x7x14 inches was taken from a 12-inch pipe.

*Tucson, Arizona*—City Engineer G. H. Atchley writes that they use rods and a self-propelling nozzle. A man hired by the year at $4.00 per day looks after the flush-tanks and cleans the sewers when stoppages occur, aided by a helper at $2.50 per day when necessary. The principal difficulty encountered is due to sand and dirt which blocks the sewer occasionally, and two or three times a year trouble is experienced from roots, but it has not been necessary to dig up a sewer for seven or eight years, the rods and nozzle being all that was needed. "We have found that it pays to keep the sewers under continuous inspection and correct minor troubles before they become major difficulties."

*Bozeman, Montana*—City Engineer L. S. Thorpe states that they have no special methods but simply get a float through the sewer with a light rope attached to it and with this draw through a 3/8-inch flexible steel cable, by which cable one or more steel brushes are drawn through the sewer, a geared windlass being used for this purpose. Most of the equipment was constructed locally. The city has also used a self-propelling nozzle with good success in its storm sewers.

*The next issue will contain a description of "Sewer Maintenance in Dayton," in which City Engineer Ivan E. Houk describes cleaning by flushing, by use of the turbine machine, buckets, and other methods.*

## Concrete Wells in Holland, Michigan

In its annual retort for the year 1922, the Board of Public Works of Holland, Michigan, gives prominent place to a description of a new well that was built during 1922, from which description we have condensed the following:

The well was carried to a depth of 72 feet. although it had been intended to carry it to 135 feet but a thick layer of large boulders prevented going deeper. The well is built of concrete pipe from the surface of the ground to the bottom, the inner diameter being 25 inches and the outer diameter 32 inches. The bottom part of this, as in the case of steel well lining, is composed of strainer sections for admitting the water. These strainer sections are about 12½ inches long and have vertical keystone-shaped grooves cast in the outer surface. Water flows into the grooves and thence down to the bottom of the section and into the well. The sections are held apart approximately 3/32 of an inch by means of bosses cast on the ends of the sections.

In building the well, a temporary steel casing was first driven the entire depth and the material removed from within it by an orange-peel bucket. A concrete block or plug was then lowered to the bottom by means of four steel cables that were fastened to it. The strainer sections were then lowered into place, being threaded over the four steel cables which passed through vertical holes cast at the quarter points of each section. Following the strainer sections,

CONCRETE STRAINER SECTION.

the plain pipe sections were threaded over the four steel cables and lowered into place. The annular space of about 5 inches between the strainer sections and the steel casing was then filled with gravel to the top of the strainer sections and with clay for the rest of the distance, and the steel casing was withdrawn during the filling.

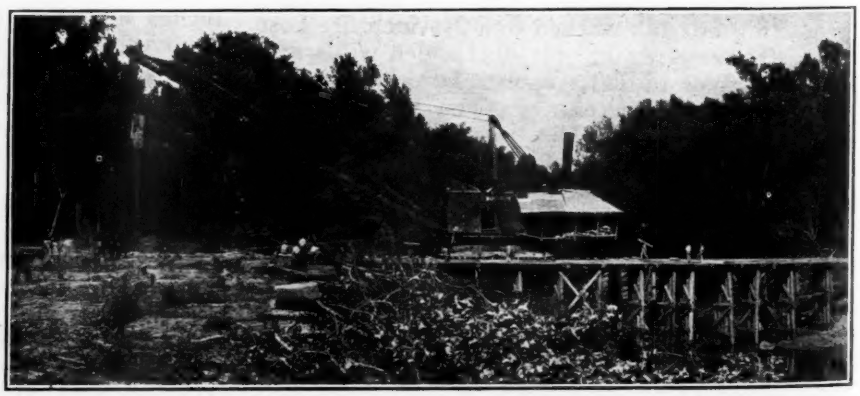
A 24-hour test was made of this well on April 15th at a continuous rate of 2,000 gallons per minute, the maximum capacity of the motor and pump available. During the first 8 hours the water level in the well lowered continuously but remained constant thereafter, the water falling to a depth of 32 feet below the original level. The suction line to the existing tubular wells was extended to this well and the entire supply drawn from it. In November an American Well Works deep well, 3-stage centrifugal pump was installed, driven by a vertical 100-horsepower Westinghouse slip ring motor with a capacity of 1,200 to 1,500 gallons per minute. The pump is provided with remote control apparatus and is operated entirely from the station. The cost of the well, including the test, was $4,728. The cost of the deep well pump, including the remote control panel and power wiring, was $4,570.

## Carrying Dragline Across Bayou

In connection with constructing about 20 miles of embankment for the Farelly Lake Levee District in Arkansas, the contractor, Reeve H. Hutchinson of Gillette, found it necessary to carry the machine across a bayou 200 feet wide and 35 feet deep. As the dragline weighed 300,000 pounds, considerable thought was given to obtaining a substantial roadway. The solution adopted by the contractor was a trestle built of 50-foot cypress piles driven five piles to the bent in two rows of bents 24 feet apart, center to center. This constituted two trestles, one for carrying each caterpillar tractor of the dragline. Each bent was capped with a 12"x12"x12' oak timber, and upon these caps were placed four lines of 12"x12"x12' oak timbers, spaced 4 inches apart and extending the full length of the bridge. The bents were placed 12 feet apart along the line of the trestle, corresponding to the 12-foot length of the stringers. The two lines of trestle were tied together with oak sway bracing for about one hundred feet in the center of the bayou.

After the bridge had been used for carrying the dragline across the stream, it was continued in use, one side to serve as a wagon road and the other to carry a standard gauge railroad over which material and machinery was carried for construction of a flood gate.

By means of this dragline and another like it, the contractor constructed a levee containing about 1½ million cubic yards of earth, all of which was taken from the river side of the embankment. The slopes of the embankment are three to one on both sides with a top width of one foot and a net height of 16 to 20 feet. Most of the work was through virgin timber, through which was cleared a 300-foot right of way. All stumps were blasted and grubbed and removed from the ground to be occupied by the fill, the surface of which was plowed to insure against seepage under the embankment.



MOVING DRAGLINE ACROSS BAYOU ON DOUBLE TRESTLE.

## Rendering Polluted Oysters Safe

A plant is operated at Inwood, L. I., for sterilizing oysters by which 15,000 bushels of oysters were prepared for market last season with the approval of Federal authorities and the New York State Conservation Commission. The plant consists of two concrete basins, each 22x25 ft. and 18 in. deep and capable of handling 200 bushels of oysters. A pump with capacity of 125 gallons a minute delivers into the basins water from a trench filled by percolation from Jamaica Bay, its salinity being 1.021. A portion of the water pumped passes through an electrolytic and returns to the pump suction where it is mixed with the other water. Electrolysis of the sea water produces hypochlorite of sodium, a sterilizing agent which is thus brought into contact with the oysters but does not touch the meat of them and therefore the dose can be made stronger than is possible in sterilizing water. The Commission imposes severe restrictions as to qualifications of operators and degree of pollution of oysters treated. The process as carried out gives a large factor of safety, so that minor variations from theoretically optimum methods and conditions may occur without impairing the effectiveness of the treatment.

# PUBLIC WORKS

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A. PRESCOTT FOLWELL, Editor


## CONTENTS



## Maintaining Sewerage Systems

While much appears in both periodical literature and text books concerning the designing and constructing of sewerage systems, little is to be found concerning the operating of them; and yet intelligent and continuous supervision and maintenance are necessary to satisfactory service. We therefore believe that unusual interest will be taken by city engineers, and others having charge of sewerage systems, in the series of articles and short descriptions dealing with sewer cleaning and other maintenance methods, the first instalment of which appears in this issue.

In the July issue we published, under the heading "Labor-Saving Devices," a list of the devices used for cleaning sewers in a considerable number of cities. The engineers of a number of these cities have kindly supplemented the questionnaire answers therein tabulated by descriptions, some brief and some extended, of the methods employed by them and the results obtained, the costs and other details.

As is only natural, different engineers have reached different conclusions as to the most satisfactory methods and appliances. This may be explained partly by the variations in conditions to be met. In some cities the greatest trouble is due to sand entering the sewers and deposited there; in others, to roots; in still others (generally combined sewers), to sticks and other large objects; while some with flat grades are continuously accumulating deposits of sewage matter.

Another probable explanation is the meagre opportunity the engineers of different cities have for learning the methods used by each other, and therefore the limitation of their knowledge of the subject to that obtained by their own experiences. It is to be hoped that the accounts we are now publishing will be followed by others on this subject, and we urge those who have any helpful experiences or ideas to send them to us for publication.

## Forethought in Public Work

It is gratifying to us, after having frequently urged in our editorial columns that plans be started months in advance for public works of importance in order to permit adequate preparation of plans and full advantage of the construction season, to find public works authorities beginning to realize the importance of this and act accordingly. One illustration is furnished by the Street Cleaning Department of New York City, which on May 24th had already begun making plans for handling the snowfall of next winter. On that date Street Cleaning Commissioner Alfred A. Taylor, and John J. Condon, in charge of snow removal, informed the Street Cleaning and Paving Committee of the Fifth Avenue Association that plans were being made for handling next winter's snow, taking advantage of methods that had proven beneficial but introducing a number of improvements suggested by past experience. The Commissioner had already ordered $1,300,000 worth of new equipment for the work.

Other illustrations may be found in several of the state highway departments, especially those where appropriations are made biennially, thus permitting plans to be made and contracts awarded well in advance for at least the second year of the biennium, even though the necessary legislation may not be decided upon sufficiently early for the first year.

Evidence of a more or less general taking of forethought in public work and consequent spread of construction throughout the year is found in the fact that never before this year have cement and other construction materials been delivered in such quantities in the early spring and even late winter.

It is to be hoped that the practice will become general, until it can not be said that any work, or purchase and delivery of material, is delayed beyond the most advantageous date by procrastinated legislation, planning or awarding of contracts.

## Fellowships in Highway Engineering

Four fellowships in highway engineering and transport will be awarded by the Board of Regents of the University of Michigan, two not later than September 10th and two not later than November 1st. These provide for investigation of subjects relative to highway transport, to hard surface pavements and to moderate-cost country roads. Each pays the sum of $250 with an allowance of $50 for expenses, and the holders do not have to pay tuition fees. They must hold Bachelors' degrees and enroll as a graduate student and candidate for the degree of Master of Science, and must be in residence either from October to February, from December to March, or from February to June. Applications can be made to Prof. Arthur H. Blanchard at the University of Michigan.

## Pennsylvania Highway Police

The Department of Highways of Pennsylvania has asked the superintendent of the State Police to organize a "Department of Highways Police" to enforce the provisions of the motor laws. At first there will be 125 men. They will be mounted on motorcycles and wear a uniform that will permit them to be recognized instantly. They will receive $100 per month and expenses.

They will be trained at the State Police Training School, where they will be thoroughly instructed in the motor laws of the state and in the use of motorcycles. The force is expected to be on duty the latter part of August.

## Boston's $3,500,000 Street Widening

The second week in June saw the beginning of the most important street improvement undertaken by Boston in recent years—the construction of a radial highway about two-thirds of a mile long, extending from Charles St. to Cornhill, formed by widening and straightening Charles and Court streets. The street will then be not less than 100 feet wide from end to end and have a maximum width of 155 feet. Slices will be taken from land and buildings, including banks and hotels, 130 pieces of land being affected. The entire cost will be about $3,500,000, but it is expected that about $1,000,000 will come back to the city in betterments.

## Water Waste in Chicago

The Western Society of Engineers has prepared and submitted to city officials of Chicago a report on the water waste problem of that city, in which it states that three-fourths of the citizens suffer inadequate water service, although the outlay for new plants is increasing at 2½ times as rapid a rate in proportion to population growth as in other cities and operating expenditures overtook revenues eight years ago and today the operating deficit is $1,000,000 a year. This is due to waste—2 gallons are pumped for each gallon used. This also seriously curtails fire protection, thereby increasing insurance rates and the cost of sewage disposal, and makes it impracticable to secure an attractive, filtered water supply.

Elimination of waste will remedy these defects in the service, double the average pressure, reduce the cost, postpone for 25 years the construction of new cribs, tunnels and stations, and thereby secure a saving of $88,000,000 in construction costs and $145,000,000 in operating costs.

## Michigan Highway Notes

In his 1922 report as state highway commissioner of Michigan, Frank F. Rogers deals briefly with a number of interesting features of the recent work of the highway department, of which the following brief notes have been made:

Practically all contracts for concrete pavement awarded during 1922 provided for a metal construction joint running lengthwise of the pavement. "This tends to define definitely the crack which usually is experienced down the center of concrete roads and also acts as a dividing line for traffic.

"The department has adopted a general policy of constructing one-course gravel roads on many of the trunk lines which are not heavily travelled at present, deeming it good policy to construct a larger mileage of this type of road and therefore serve a greater number of people than to construct a higher type of road of decreased mileage and therefore decreased service to the people in general."

BRIDGES—During the past two years the department has eliminated a great percentage of the steel bridges formerly in use by using concrete girder designs up to 90-foot spans. The designs adopted have curved top cords and bottom cord brackets. The 90-foot concrete girders have been tested and found exceptionally stiff and remarkably free from impact and vibration.

The department has paid more attention than formerly to bridge maintenance. The work done includes cleaning and scraping, painting, floor repairs, new floors, repairs to super-structures, riprapping, repairs to substructure, cleaning of channels at bridge site, and replacing and repairs of stringers. The department operates five 2-ton trucks on pneumatic tires with air spray painting outfits and small air tools, each under a competent foreman and crew of about three additional men. During the past two years it painted 118 bridges, placed new floors on 29 bridges and repaired floors and other portions of 59 others. At least 60 days is allowed between successive paintings and preferably a year, three coats of paint being applied where the steel is in a badly rusted condition, with a minimum of two coats otherwise. An average of over $40,000 a year has been spent in this work.

CLEANING UP ROADSIDES—It has been found that, in removing noxious weeds which the law requires shall be cut and destroyed, many shrubs and other attractive growths are destroyed indiscriminately, these including the wild rose, hawthorn and dogwood, which the department believes should generally be saved, as should even the sumach and elder and such vines as the wild grape and bittersweet.

Nurseries sell these for ornamental planting and yet thousands of dollars worth of them along the roadside are destroyed each year.

"In general, the shoulders, ditches and about two feet outside the ditches should be kept mowed. From there to the edge of the right-of-way all noxious weeds, dead brush and rubbish should be removed, but desirable shrubs and young trees should be saved and properly pruned."

Maintenance costs are given for the two years covered by the biennial report, for each of the several classes of roads in use. Reducing these to the average cost per mile, we find that during the year 1921-22 the costs were as follows: Earth, $268.57; stamp sand, $415.66; gravel, $666.94; waterbound macadam, $806.09; bituminous macadam, $525.95; bituminous concrete, $514.09; cement concrete, $829.81; brick, $133.36; unclassified, $512.34. The last item includes sections of road comprising more than one type of surface. The cost of concrete is unusually high, largely because the majority of these roads were originally built too narrow to carry present traffic and many have had to be widened and in some cases reconstructed, which cost has been charged to maintenance.

# Cost of Concrete Pavement

J. H. Cahill gives the following figures for concrete surfacing performed by him in 1919 on a stretch of 6.38 miles of road beginning at the limits of Lexington, Kentucky. The average haul was 3.69 miles over a comparatively good macadam road with no grades over 3 per cent. Weather conditions were above the average and absolutely no delays were encountered because of slow delivery of material. The job comprised 67,373 square yards of plain concrete 18 feet wide, 6 inches thick on the sides and 8 inches in the center. Expansion joints were set only at the end of each day's run. The itemized costs were as follows:

| | |
|---|---|
| 24,053 bbls. cement @ $2.70 less 60 cts. for sacks and 5 cts. discount, credit taken for sacks returned; cost of handling and return freight added | $51,211.30 |
| 8.580 tons sand f. o. b. Louisville @ 80 cts. | 6,864.00 |
| 15.875 tons gravel f. o. b. Louisville @ 80 cts. | 12,700.00 |
| 1,620 ft. 9 in. expansion joint delivered at Lexington | 193.20 |
| Freight on 24,455 tons sand and gravel, Louisville to Lexington, @ 80 cts. | 19,564.00 |
| Unloading sand, gravel, cement | 6,353.70 |
| Drayage by contract 16½ cts. ton mile and extra trucking | 17,194.00 |
| Water line and pumping (labor laying, maintaining and pumping) | 6,332.30 |
| Mixing, placing and finishing concrete | 17,675.80 |
| Covering and watering (labor only, no charge for water) | 5,021.65 |
| Equipment 25% of actual cost, $21,167.93 | 5,274.20 |
| Bond, liability and incidentals (pro rated) | 7,846.90 |
| Total | $156,431.05 |

The total averaged $2.32 per square yard. This does not include the cost of preparing the subgrade, as this was paid for separately and cost $6,624.60, or a fraction less than 10 cents per square yard.

Mr. Cahill has also made an estimate of what this work would cost today. Cement being a little more than 20 per cent higher net, sand and gravel 10 cents more per ton and freight 50 cents more, drayage 22 cents per ton-mile with most of the other items figured the same. This gives a total of $199,621.79, or an average of $2.90 per square yard, or 27½ per cent greater than in 1919.

# Sod in Earth Road Construction

Not so many years ago road construction in the prairie states quite commonly consisted of digging sod from the sides and throwing it into the center of the road where it was more or less surfaced into a crown and left to do its worst to the traffic. The writer can remember when the same practice prevailed in the country sections of New York and other eastern states, where roads repaired in this way were for weeks in considerably worse condition than they had been before.

The "Service Bulletin" of the Iowa State Highway Commission states that this practice continued in Iowa until 1914, in which year blade-grader operators began the practice of throwing a thin coat of sod from the shoulder to the center of the road on the first trip and distributing it uniformly and then covering this with clean earth from the ditches and shoulders from which the sod had already been removed. This worked well in constructing the road where a crown had to be made, but in reshaping a road which was already crowned and a large part of which had grown up to grass except in a narrow travel way, it was not practicable to remove all of the sod and pile it in the middle of an already crowned road and then cover this with dirt.

According to the "Service Bulletin," during the past two or three years a blade-grader expert in the employ of the commission, O. M. Briley, has been working out a new system of handling the sod under these conditions. Mr. Briley has described the method of working as follows:

"No one general rule or method of procedure will apply to all roads and all conditions," says Mr. Briley. "Generally I find that one plan which I will describe, works satisfactorily in most cases when the crew goes out to rebuild or reshape an old road which has been previously put to permanent grade. The same system should apply to reshaping most of the roads which have been previously put to standard cross section only by the blade-grader.

"We find the stakes set by the engineers, usually in the bottom of the side ditch or where the side ditch is to be. I measure the width apart of the front grader wheels and then set a new line of stakes or move the old ones just the width of the grader wheels inside the first line up onto the shoulder of the road. With my stakes well up on the shoulder of the road I have a good, clear line to follow in making my first cut and usually a good footing for

both the engine and grader. I find this is a great help in making a good looking, straight shoulder line for my road grade.

"On the first cut, I set the outer edge of the blade as high as possible, sending the cutting point down so that it will gouge out a rather deep and narrow furrow. As I go I take out my entire new line of shoulder stakes. Material thrown out of this furrow frequently carries with it considerable grass and rubbish but seldom heavy sod. This, of course, goes toward the center of the road into more or less of a ridge but usually there is no difficulty in covering the material up in later operations. On my next trip around, the deep furrow forms a trench to guide and hold my left front wheel for the first heavy cut which usually gives me the shoulder line of the grade and the center line for the bottom of my side ditch. The furrow also provides the trench in which to throw the sod and grass that comes out on this second round.

"Usually one cut gives the lineup for my side ditch and shoulder and gets most of the grass and sod up into the trench. As this material comes off the blade it is usually turned sod side down into the bottom of the trench and left with a thin coating of fairly clean earth on top. I then make as many cuts as are necessary to open the side ditch properly, clean off the back slope and get the material needed to fill out and shape up the road grade in the customary manner. All this latter dirt is, of course, thrown on top of the sod and provides good, clean earth for finishing and working up the traffic surface.

"Occasionally when the traffic surface is badly weed grown a considerable distance out from the shoulders making too much grass and sod to throw toward the center when making the first trench cut described above, I make a thin cut on the first trip around, throwing the skimmed off sod and weeds out into the side ditch. The next trip around the trench is made and on the third trip, or the first trip made down the side ditch, the skimmed off sod and grass with additional material is thrown back on top of the road and into the trench. The building and shaping of the road grade is then continued as described above."

## Truck Weights and Gasoline Taxes

Recent reports from most of the states show a spread of the idea of raising highway revenues by taxing gasoline; also that of setting a limit to the gross weight of motor vehicles, although there is no general uniformity in the limit set.

Thirty-three states now tax gasoline, and of these eleven levy a 2-cent tax and three others will advance the rate from 1 cent to 2 cents next January. In eighteen states the tax is now 1 cent; while in one state it is 2½ cents and in three states it is 3 cents.

The maximum gross weights allowed, according to the latest figures at hand, are: 12,000 pounds in New Mexico; 12,500 pounds in Vermont; 15,000 pounds in North Carolina; 16,000 pounds in Colorado and Florida; 20,000 pounds in Alabama, Iowa, Maine, Maryland, New Hampshire, Ohio, South Dakota, Tennessee, Utah and Virginia; 22,000 pounds in Delaware, Oregon and Texas; 24,000 pounds in Indiana and Washington; 25,000 pounds in Connecticut, Nevada and Wyoming; 26,000 pounds in Pennsylvania; 28,000 pounds in Minnesota and New York; 30,000 pounds in California, and 32,000 pounds in Illinois.

As the motor vehicle manufacturers of the country are said to be almost unanimous in the opinion that the 3 or 3½-ton truck is the most economical unit, with the 5-ton as the economical limit, it seems probable that the states will agree on 20,000 to 25,000 as a universal standard.

## Iowa Board of Engineering Examiners

The Iowa State Board of Engineering Examiners is now organized with the following membership: Seth Dean, Chairman, address Glenwood, Ia.; L. M. Martin, Vice-Chairman, address Atlantic, Ia.; Alvin LeVan, address Des Moines, Ia.; B. F. Fleming, address Iowa City, Ia.; C. S. Nickols, address Ames, Iowa.

All correspondence or business matters for the Board should be addressed to W. C. Merckins, Secretary, State House, Des Moines, Iowa.

# Street and Highway Statistics

**Replies to questionnaires, supplementing the tables published in the February, March and April issues of Public Works. Amounts of city paving and highway improvement done in 1922 and contemplated in 1923**

Statistics obtained by us from officials of several hundred cities relative to the amount and cost of street pavement laid during 1922 were tabulated and published by us in the issues of February and March, and those relative to county and state roads improved during 1922 and also work contemplated for 1923 were published in the April issue. Since the tabulation of these replies, others have been received, and are given in the tables following.

In addition to these tables, others are given that were crowded out of the previous issues by lack of space, these giving information concerning "Municipal Repair Plants," "Waterbound Macadam and Gravel Pavements and Cement Sidewalks," and "Reinforcement and Resurfacing" of county roads.

In the last table is shown a great variety of kinds and weights of reinforcement, although the influence of state highway standards is shown by uniformity among the cities of a given state, as in Illinois, Iowa and New York. The present tendency seems to be toward the development of standards of weight throughout the country.

# Municipal Repair Plants

**Replies to the questions: "Have you a municipal plant used for repairing pavements?" "What are the chief appliances in this plant?" "Do you do original paving with it as well as repair work?" Nearly one-half do more or less original paving.**

| City | Chief Appliances of Plant. | Does City Do Original Paving? |
|---|---|---|
| Birmingham, Ala | Concrete mixers, portable tanks, heaters | No |
| Whittier, Cal | Mixers, asphalt kettles, trucks, etc. | No |
| Santa Rosa, Cal | Heater, 3-roll drier, mixer—capacity 40 cu. yd. per day | Yes |
| Denver, Col | Up-to-date standard asphalt plant | Yes |
| Pueblo, Col | Electrically operated heating drum and pug mixer | No |
| New London, Conn | Heating plant and mixer | Yes |
| Tallahassee, Fla | Asphalt kettle and small concrete mixer | No |
| Americus, Ga | Concrete mixer and tar tank | Yes |
| Boise, Ida | Rotary drier, asphalt tank, screen, twin pug mixer | Yes |
| Oak Park, Ill | Anderson road repair outfit, 1922 model | No |
| Fort Wayne, Ind | Complete plant, 1,000 sq. yd. per day capacity | No |
| Gary, Ind | Concrete mixer, roller, kettles, etc. | A little |
| Eagle Grove, Ia | Portable asphalt heater and tank and street tools | |
| Waterloo, Ia | Asphalt heater | No |
| Wichita, Kan | Hot mixer, asphalt kettle, truck | No |
| Paducah, Ky | Tar melting pots and truck and tools | |
| Lewiston, Me | Tar kettles, roller and scarifier | Yes |
| Attleboro, Mass | Crusher, heating and mixing plant | No |
| Hudson, Mass | Mixer, roller, tar kettle, small tools | Yes |
| North Adams, Mass | Concrete mixer, brick paving tools | No |
| Pittsfield, Mass | Heating pans and asphalt kettles | No |
| Waltham, Mass | Concrete mixer and asphalt tank | No |
| Worcester, Mass | Asphalt plant | Yes |
| Grand Rapids, Mich | Portable asphalt plant | No |
| Hastings, Mich | Concrete mixer and asphalt heater | Yes |
| Holland, Mich | Roller, asphalt kettle, mixer with blower attached | No |
| Muskegon, Mich | Roller and kettle | No |
| Owosso, Mich | Mixer, boxes, small tools for brick | All brick paving |
| Saginaw, Mich | 1,600-yd. plant fully equipped | Yes |
| Sault Ste. Marie, Mich | Two asphalt heaters, 2 bituminous mixers, rollers, hand tools | Yes |
| Cape Girardeau, Mo | Portable tar kettle, roller, trucks, small tools | No |
| St. Joseph Mo | Asphalt plant being built by Hetherington & Berner | No |
| St. Louis, Mo | Complete asphalt plant, rollers, hot wagons | Yes |
| Lincoln, Neb | Asphalt mixer and rollers | Yes |
| Norfolk, Neb | Small mixer, "cooker" and hand tools | No |
| Laconia, N. H | Crusher, tar pots, roller | Yes |
| Nashua, N. H | Complete asphalt plant | Yes |
| Bridgeton, N. J | Sheet asphalt and macadam plant | Not much |
| Camden, N. J | 1,000-yd. plant complete, oil tanks, storage bins | Yes |
| Newark, N. J | Complete plant. See description | Bids on all asphalt work. |
| So. Orange, N. J | Small mixer, steam roller, scarifier, tools | ...... |
| Summit, N. J | Mixer for bituminous material, motor truck, steam roller | No |
| Trenton, N. J | Cummer asphalt plant, 750-yd. | No, expect to |
| Corning, N. Y | Concrete mixer and asphalt kettles | No |
| Cortland, N. Y | Cummer asphalt plant, 800-sq. yd. capacity | Yes |
| New York-Manhattan | 3,000-yd. asphalt plant and street equipment, kettles, etc., for stone pavement repairs | No |
| Niagara Falls, N. Y | Portable asphalt plant | No |
| Schenectady, N. Y | 800-yd. plant, 5-ton roller | No |
| Watertown, N. Y | Mixer and asphalt pan heater | No |
| Waverly, N. Y | Concrete mixer, asphalt heater, tractors, etc. | Yes |
| Cincinnati, O | All appliances necessary for asphalt work | No |
| Columbus, O | Asphalt plant, all equipment for repairing all types of pavement | No |
| Dayton, O | Asphalt plant | Small asphalt jobs |
| Muskogee, Okla | Asphalt mixer, drier, kettles, tandem roller, 3-wheel macadam roller, 4 trucks | Only for city property |
| Eugene, Ore | Tanks, heater, kettle, hot roller, tandem roller, concrete mixer | No |
| Harrisburg, Pa | Sand heater, asphalt storage tank, mixer | No |
| Perkasie, Pa | Stone crusher, asphalt heater, steam roller | Yes |
| Reading, Pa | 750-yd. asphalt plant | No |
| Scranton, Pa | 1,500-yd. Cummer plant | Furnishes asphalt material to contractors |
| Providence, R. I | Four stone crushers, 2 screening plants, 8 steam road rollers, asphalt kettle and oil spreaders | Yes |
| Greenville, S. C | Asphalt heater and 2 rollers | No |
| Jackson, Tenn | Asphalt tank, heater, distributor | Yes |
| Bonham, Tex | Portable asphalt heater | No |
| Salt Lake, Utah | 750-yd. Hetherington & Berner asphalt plant complete | No |
| Barre, Vt | Asphalt kettle and cement mixer | Yes |

## SHEET ASPHALT AND ASPHALT CONCRETE

| City | Sheet Asphalt Area sq. yd. | Sheet Asphalt Cost | Asphalt Concrete Area sq. yd. | Asphalt Concrete Cost |
|---|---|---|---|---|
| **California:** | | | | |
| Santa Ana | 46,404 | $115,269.00[l] | 17,718 | $31,814.00[l] |
| **Connecticut:** | | | | |
| Hartford | 2,521 | 10,261.00[l] | .... | ...... |
| New Haven | 12,877 | 32,800.00[d] | 5,763 | 13,600.00[d] |
| **Indiana:** | | | | |
| Anderson | .... | ...... | 6,000 | 18,000.00[k] |
| LaPorte | 51,900 | { 1.70[h] { 3.20 | .... | ...... |
| **Iowa:** | | | | |
| Boone | 140,000 | 2.46[o] | .... | ...... |
| Davenport | 11,915 | 38,702.00[e] | 10,494 | 40,556.00[e] |
| **Kansas:** | | | | |
| Kansas City | .... | ...... | 25,800 | 72,934.00[t] |
| Leavenworth | .... | ...... | 30,000 | 1.14[h] |
| Topeka | .... | ...... | 42,594 | 2.45[o] |
| **Massachusetts:** | | | | |
| Haverhill | .... | ...... | 10,346 | 14,237.00[a] |
| Lexington | .... | ...... | 500 | 1.25 |
| **Michigan:** | | | | |
| Bay City | .... | ...... | 17,979 | 63,907.00 |
| Flint | 57,000 | 3.56[d] | .... | ...... |
| Lansing | 80,000 | ...... | .... | ...... |
| **New Jersey:** | | | | |
| Jersey City | .... | ...... | { 38,832 { 83,832[p] | { 3.34[o] { 2.60[h] |
| Long Branch | 87,000 | 3.00 | .... | ...... |
| Passaic | 950 | 30,000.00 | 6,511 | 104,567.00[k] |
| West New York | .... | ...... | 15,800 | 1.54[b] |
| **New York:** | | | | |
| Syracuse | 30,600 yd. | 138,080.00 | 24,700 | 124,332.00 |
| **Ohio:** | | | | |
| Lorain | .... | ...... | 11,800 | 41,000.00[k] |
| **Oklahoma:** | | | | |
| Enid | .... | ...... | 20,633 | 3.37[o] |
| **Oregon:** | | | | |
| Corwallis | .... | ...... | 19,700 | ...... |
| **Pennsylvania:** | | | | |
| Pottsville | 43,000 | 3.50[o] | .... | ...... |
| **Washington:** | | | | |
| Walla Walla | .... | ...... | 38,000 | 1.65 |
| **Wisconsin:** | | | | |
| Green Bay | 39,056 | 119,110.00 | .... | ...... |
| Oshkosh | .... | ...... | 25,160 | 75,480.00[l] |

[a]Includes picking up surface of old macadam, grading and furnishing some new stone for base. [b]Wearing surface, excavation, curb. [c]Laid on old stone block. [d]Entire improvement. [e]Surface, base, grading, curb and gutter. [g]6 in. base, $1.39; 2 in. top, $1.07; curb and gutter, $0.75; extra, $0.65. [h]Top only. [k]Surface, base, grading and curb. [l]Wearing surface, base and grading. [o]Surface and base. [p]Part was pavement complete, part was resurfacing. [t]Surface, grading, drains and catch basins.

## STONE BLOCK AND BRICK

| City | Stone Block Area | Stone Block Cost | Brick Area | Brick Cost |
|---|---|---|---|---|
| **Connecticut:** | | | | |
| New Haven | .... | ...... | 2,764 | $6,000.00[l] |
| **Indiana:** | | | | |
| W. Lafayette | .... | ...... | 9,000 | 2.52[v] |
| **Iowa:** | | | | |
| Davenport | .... | ...... | 3,635 | 15,747.00[h] |
| | | | 12,148[a] | 47,700[v] |
| **Kansas:** | | | | |
| Kansas City | .... | ...... | 44,586.4 | 158,203.00[l] |
| Topeka | .... | ...... | 3,979 | 3.35[b] |
| **Massachusetts:** | | | | |
| Somerville | 12,966 | $78,013.00[c] | .... | ...... |
| **New Jersey:** | | | | |
| East Orange | 3,974 | 7.12[c] | .... | ...... |
| West New York | 250 | 1.85[a] | .... | ...... |
| West Orange | 800 lin.ft. | 2.49[a] | .... | ...... |

## STONE BLOCK AND BRICK

| City | Stone Block Area | Stone Block Cost | Brick Area | Brick Cost |
|---|---|---|---|---|
| **New York:** | | | | |
| Elmira | .... | ...... | 12,849 | 4.33[c] |
| Syracuse | 101 | ...... | 4,709 | ...... |
| **Ohio:** | | | | |
| Jackson | .... | ...... | 31,180[m] | 100,000.00[e] |
| Lorain | .... | ...... | 17,600 | 73,600.00[h] |
| **Pennsylvania:** | | | | |
| Huntingdon | .... | ...... | 245 | 3.80[c] |
| New Castle | .... | ...... | 0.377 mi. | 29,489.00[d] |
| **Texas:** | | | | |
| Tyler | .... | ...... | 10,000 | 3.25[c] |
| **Washington:** | | | | |
| Seattle | .... | ...... | 59,431 | 4.75 |
| **Wisconsin:** | | | | |
| Oshkosh | .... | ...... | 436 | 2,071.00[e] |
| Sheboygan | .... | ...... | 300 | 4.00[e] |

[a]Surface only. [b]Surface and base. [c]Surface, base and grading. [d]Surface, base, grading and curb. [h]Surface, base, grading, curb and gutter. [l]Entire improvement. [l]Surface, grading, drains and catch-basins. [m]On 8-in. slag base. [v]Repaving on old base.

## OTHER KINDS

| City | Kind of Pavement | Area, Sq. Yd. | Cost |
|---|---|---|---|
| **Illinois:** | | | |
| Chicago | Creosoted wood blk | 1,505 | ...... |
| | Sandstone | 13,665 | ...... |
| Rockford | Creosoted wood blk | 1,854 | $9,628.00 |
| **Indiana:** | | | |
| Fort Wayne | Plain conc alleys | 21,309 | 43,862.00 |
| **Massachusetts:** | | | |
| Haverhill | Miscellaneous | 1,241 | ...... |
| Lowell | Amesite | 14,301 | ...... |
| **Michigan:** | | | |
| Grand Rapids | Tar surface | 13.5 mi. | ...... |
| **Minnesota:** | | | |
| Minneapolis | Creosoted wood blk | 65,418 | 328,330.00 |
| Stillwater | Tar surface | 153.00 | 7,130.00 |
| **Montana:** | | | |
| Kalispell | Cinder | 2,000 | 400.00 |
| **New Hampshire:** | | | |
| Berlin | Miscellaneous | 1,343.7 | 1.60 |
| **New Jersey:** | | | |
| East Orange | Creosoted wood blk | 163 | 6.80[c] |
| | Asphalt block | 7,262 | 2.35 & 3.40 |
| Edgewater | Asphalt block | 1,200 | 7,000.00 |
| New Brunswick | Asphalt block | 10,443 | 46,084.00 |
| **New York:** | | | |
| Amsterdam | Asphalt block | 700 | 1,800.00 |
| Glens Falls | Asphalt block | 7,564 | 3.98 |
| Jamestown | Asphalt block | 3,126 | 15,762.00 |
| Port Chester | Asphalt block | 25,000 | ...... |
| Rochester | 2½" asphalt block | 6,050 | 4.21[b] |
| | 2" creo wood block | 3,850 | 3.56[b] |
| **North Carolina:** | | | |
| Charlotte | Oiled macadam | 59,826 | ...... |
| Durham | Durax | 3,461 | 6.33 |
| **Ohio:** | | | |
| Dayton | Creosoted wood blk | 7,472 | 43,273.00 |
| **Oklahoma:** | | | |
| Tulsa | Vibrolithic | 46,620 | 6.00 |
| **Pennsylvania:** | | | |
| Hazeltown | Amiesite | 20,826 | 74,275.00 |
| | Asphalt block | 2,357 | 11,527.00 |
| **Vermont:** | | | |
| Rutland | Miscellaneous | 440 | 1.62 |
| **Washington:** | | | |
| Seattle | Sandstone | 500 | ...... |

[a]Surface only. [b]Surface and base. [c]Wearing surface, base and grading.

# WATERBOUND MACADAM AND GRAVEL PAVEMENTS AND CEMENT SIDEWALKS

| City | Waterbound Macadam | | Gravel | | Cement Sidewalks | |
|---|---|---|---|---|---|---|
| | Area sq. yd. | Cost | Area sq. yd. | Cost | Area sq. ft. | Cost |
| **Alabama** | | | | | | |
| Birmingham | 15,498.28 | $30,961.00 | ........ | ........ | 43,704.17 | $60,928.00 |
| **Arkansas** | | | | | | |
| Searcy | ........ | ........ | 20,000 | $20,000.00 g | ........ | ........ |
| **California** | | | | | | |
| Monterey | ........ | ........ | 20,000 ft. | .14 | ........ | ........ |
| Oakland | .077 mi. | 6,680.00 | ........ | ........ | 335.811 | 52,129.00 |
| Santa Ana | ........ | ........ | ........ | ........ | 200.000 | ........ |
| Santa Barbara | ........ | ........ | ........ | ........ | 119.466 | 23,893.00 |
| Santa Rosa | ........ | ........ | ........ | ........ | 50.000 | .18 |
| Whittier | ........ | ........ | ........ | ........ | 47,799 | .20 |
| **Colorado** | | | | | | |
| Fort Collins | ........ | ........ | ........ | ........ | 3.000 | .16 |
| Pueblo | ........ | ........ | ........ | ........ | 15,000 | .18 |
| **Connecticut** | | | | | | |
| Ansonia | ........ | ........ | ........ | ........ | 9,000 | .222 |
| New London | 12,000 | ........ | 8,000 | ........ | 119,683 | ........ |
| Williamantic | ........ | ........ | ........ | ........ | 30,574 | ........ |
| **Delaware** | | | | | | |
| Wilmington | 3,411 | ........ | ........ | ........ | ........ | ........ |
| **District of Columbia** | | | | | | |
| Washington | ........ | ........ | ........ | ........ | 405,000 | .22¼ |
| **Georgia** | | | | | | |
| La Grange | ........ | ........ | ........ | ........ | 6 mi. | .15 |
| Macon | ........ | ........ | ........ | ........ | 1.3 mi. | ........ |
| **Idaho** | | | | | | |
| Lewiston | ........ | ........ | ........ | ........ | 45,000 | .15½ |
| **Illinois** | | | | | | |
| Canton | ........ | ........ | ........ | ........ | 5,000 | ........ |
| Chicago Heights | ........ | ........ | ........ | ........ | 11.600 | 2.900.00 |
| Clinton | ........ | ........ | ........ | ........ | 4.000 | 1,000.00 |
| DeKalb | ........ | ........ | ........ | ........ | 2.700 | 600.00 |
| Galva | ........ | ........ | ........ | ........ | 9.000 | 1,440.00 |
| Granite City | ........ | ........ | ........ | ........ | 80,000 | .20 |
| Marion | ........ | ........ | ........ | ........ | 324,168 | .25 |
| Moline | ........ | ........ | ........ | ........ | 264,000 | .15 |
| Riverside | ........ | ........ | ........ | ........ | 99,000 | 24,115.00 |
| Rockford | ........ | ........ | ........ | ........ | 230.472 | ........ |
| Waukegan | ........ | ........ | ........ | ........ | 34,720 | 9,095.00 |
| **Indiana** | | | | | | |
| Anderson | ........ | ........ | 3,240 | 4,775.00 | 28.310 | 4,765.00 |
| Decatur | ........ | ........ | ........ | ........ | 7,670 | .18 |
| Elwood | ........ | ........ | ........ | ........ | 15.300 | 3.250.00 |
| Fort Wayne | ........ | ........ | ........ | ........ | 405,810 | 40,885.00 |
| Frankfort | ........ | ........ | 8 mi. | ........ | ........ | ........ |
| Gary | ........ | ........ | ........ | ........ | 7.477 | ........ |
| Huntington | ........ | ........ | ........ | ........ | 9,000 | 1,800.00 |
| Jasonville | ........ | ........ | ........ | ........ | 16,000 | .28 |
| LaPorte | ........ | ........ | ........ | ........ | 1,000 | ........ |
| Marion | ........ | ........ | ........ | ........ | 70,000 | 9,100.00 |
| Martinsville | ........ | ........ | 4½ mi. | 3,600.00 | ........ | ........ |
| Richmond | ........ | ........ | ........ | ........ | 17,186 | .22 |
| Terre Haute | ........ | ........ | ........ | ........ | 73,400 | 12,300.00 |
| West Lafayette | ........ | ........ | ........ | ........ | 7,500 | .18 |
| Winchester | ........ | ........ | 1,800 | ........ | 4,800 | .30 |
| **Iowa** | | | | | | |
| Boone | ........ | ........ | ........ | ........ | 50,000 | .15½ |
| Cedar Rapids | ........ | ........ | ........ | ........ | 31,347 | 5,745.00 |
| Charles City | ........ | ........ | ........ | ........ | 16,915 | ........ |
| Creston | ........ | ........ | ........ | ........ | 10,000 | ........ |
| Eagle Grove | ........ | ........ | 26,700 | 1,540.00 | 1,500 | .15 |
| Emmetsburg | ........ | ........ | ........ | ........ | ........ | ........ |
| Fort Dodge | ........ | ........ | 15,000 | .30 | 11,000 | .134 |
| Glenwood | ........ | ........ | ........ | ........ | 3,996 | ........ |
| Muscatine | ........ | ........ | 3,960 | 3,600.00 | 9,000 | 1,125.00 |
| Ottumwa | ........ | ........ | ........ | ........ | 150,000 | .15 |
| Sioux City | ........ | ........ | ........ | ........ | 85,000 | 27,100.00 |
| **Kansas** | | | | | | |
| Atchison | ........ | ........ | ........ | ........ | 10,000 | .19½ |
| Junction City | ........ | ........ | ........ | ........ | 49,500 | .13¾ |
| Kansas City | ........ | ........ | ........ | ........ | 17,167 | 2,378.00 |
| Parsons | ........ | ........ | ........ | ........ | 6,000 | .18 |
| Salina | ........ | ........ | ........ | ........ | 25,000 | $3,000.00 |
| Topeka | ........ | ........ | ........ | ........ | 50,000 | 0.18½ |
| Wichita | ........ | ........ | ........ | ........ | ........ | 30.500.00 |
| **Kentucky** | | | | | | |
| Bowling Green | 55,000 | $27,500.00 | ........ | ........ | 135,000 | 15,000.00 |
| Corbin | ........ | ........ | ........ | ........ | 40,500 | .25 |
| Paducah | ........ | ........ | ........ | ........ | 1,800 lin. ft. | ........ |
| **Maine** | | | | | | |
| Augusta | ........ | ........ | ........ | ........ | 2,133 | .36 |
| Bangor | ........ | ........ | 5 mi. | $10,000.00 | 5,400 | .25½ |
| Portland | ........ | ........ | ........ | ........ | 16,407 | ........ |
| Rockland | ........ | ........ | ........ | ........ | 738 | 262.00 |
| **Massachusetts** | | | | | | |
| Athol | ........ | ........ | 2 mi. | ........ | 1 mi. | ........ |
| Brockton | ........ | ........ | 25,460 | 1.10 | 9,690 | ........ |
| Fitchburg | ........ | ........ | ........ | ........ | 18,900 | .25½ |
| Greenfield | ........ | ........ | ........ | ........ | 26,100 | .23 |
| Haverhill | ........ | ........ | ........ | ........ | 1,229 | 416.00 |
| Hudson | ........ | ........ | 1½ mi. | 12,000.00 | ½ mi. | .222 |
| Lowell | 28,003 | ........ | ........ | ........ | 4,185 | ........ |
| Peabody | 2,000 | .41 | ........ | ........ | ........ | ........ |
| Pittsfield | ........ | ........ | ........ | ........ | 43,578 | .31½ |
| Somerville | ........ | ........ | ........ | ........ | 40,347 | 13,931.00 |
| Webster | ........ | ........ | ........ | ........ | 4,506 | 2.60[a] |
| Worcester | ........ | ........ | ........ | ........ | 23,006 | .41⅔ |

# WATERBOUND MACADAM AND GRAVEL PAVEMENTS

| | Waterbound Macadam | | Gravel | | Cement Sidewalks | |
|---|---|---|---|---|---|---|
| | Area sq. yd. | Cost | Area sq. yd. | Cost | Area sq. ft. | Cost |
| **Michigan** | | | | | | |
| Ann Arbor | | | | | | .18 |
| Bay City | | | | | 10,067 l. ft. | 7,928.00 |
| Dowagiac | | | | | 18,360 | .119 |
| Grand Rapids | | | 9,380 | 6,780.00 | 30 mi. | |
| Hastings | | | | | 13,300 | 1,330.00 |
| Holland | | | | | 18,000 | .13 |
| Flint | | | 16,700 | 1.20 | 330,400 | .20 |
| Iron Mountain | | | 24,000 | 5,760.00 | | |
| Mt. Clemens | | | 2.500 | 1.80 | 10.000 | .25 |
| Pontiac | | | 16,000 | | 108.000 | .118 |
| Port Huron | | | 18 194 | 8,127.00 | | |
| Saginaw | | | 28.088 | 1.02 | | |
| Sault Ste. Marie | | | 30,000 | | 26,000 | |
| Three Rivers | | | | | 1,300 | .11 |
| **Minnesota** | | | | | | |
| Duluth | | | | | 200,000 | |
| Ely | | | 700 | 750.00 | 3,600 | 720.00[c] |
| Faribault | | | 30,000 | | | |
| Fairmont | | | | | 10,800 | 1,712.00 |
| Minneaoplis | | | | | 1,697,400 | 219,862.00 |
| New Ulm | | | 10.000 | .35 | 27,000 | .121 |
| Rochester | | | 8 mi. | | 4½ mi. | |
| So. St. Paul | | | | | 3,000 l. ft. | 2,340.00 |
| Stillwater | | | 1,083 | 1,726.00 | 3,849 | 462.00 |
| Winona | | | | | 5,454 | .13 |
| **Missouri** | | | | | | |
| Cape Girardeau | | | | | 7,350 | 1,640.00 |
| Fulton | 2,000 | | 3,000 | | | |
| Hannibal | | | 20,000 | 25,000.00 | 19,800 | 20,000.00 |
| Jefferson City | | | | | 3,000 | .18 |
| Joplin | 3,348 | 3,470.00 | | | | |
| Kansas City | | | | | 10.02 mi. | 49,654.00 |
| Marshall | | | | | 15,000 | .18 |
| Monett | | | 22,000 | 8,800.00 | 10,686 | 1,687.00 |
| Poplar Bluff | | | | | 1,000 | .18 |
| Sedalia | | | | | 1 mi. | 3,168.00 |
| Springfield | | | | | ½ mi. | .18 |
| **Montana:** | | | | | | |
| Anaconda | | | | | 7,000 | |
| Billings | | | | | 72,232 | 0.18½ |
| Bozeman | | | 8,300 | 8,664.00 | 12,960 | 3,240.00 |
| Great Falls | | | 16.625 | 9,635.00[a] | | |
| Kalispell | | | 6,000 | 3,000.00[k] | 1,000 | 220.00 |
| Lewistown | | | | | 15,000 | 3,300.00 |
| **Nebraska** | | | | | | |
| Chadron | | | | | 30,000 | .17 |
| Columbia | | | 5 mi. | | | |
| Grand Island | | | | | 16.000 | .13½ |
| Lincoln | | | | | 17,984 | 1,575.00 |
| Omaha | | | | | 21.3 mi. | 90,000.00 |
| **New Hampshire** | | | | | | |
| Berlin | 4,000 | $1.50 | | | 20,963 | .30 |
| Nashua | | | | | 6,387 | |
| **New Jersey** | | | | | | |
| Clifton | | | | | 20,000 | .31 |
| Edgewater | | | | | 27,400 | 8,800.00 |
| Freehold | | | 8,000 | 1.00 | 28,000 | .20 |
| Millville | | | 12,370 | | | |
| Newton | 7,800 | 3,000.00 | 16,800 | 4,872.00 | | |
| Passaic | | | | | 3,722 | 936.00 |
| Phillipsburg | 5,450 | | | | | |
| Plainfield | 20,800 | 26,200.00 | | | 13,942 | 3,000.00 |
| Rahway | | | | | 13,000 | 4,600.00 |
| Roselle Park | | | | | 8,295 | 2,070.00 |
| Rutherford | | | | | 0.5 mi. | 2,500.00 |
| So. Orange | | | | | 30,880 | 4,845.00 |
| Summit | | | | | 500 | .24½ |
| Wallington | | | | | 5,364 | 4,661.00 |
| West New York | | | | | 19,000 | .12 |
| **New York** | | | | | | |
| Amsterdam | | | | | 2,000 | 6,000.00 |
| Buffalo | | | | | 219,818 | |
| Corning | | | 35,120 | 28,240.00 | 14,634 | 2,547.00 |
| Elmira | | | | | 113,526 | .18 |
| Endicott | | | | | 15,000 | .18 |
| Fulton | | | | | 10,000 | .17 |
| Gloversville | | | | | 4,725 | 1,134.00 |
| Lackawanna | | | | | 3,600 l. ft. | 1,040.00 |
| Lancaster | 0.9 mi. | | | | 12,000 | 2,200.00 |
| Niagara Falls | | | | | 43,521 | 8,223.00 |
| No. Tonawanda | | | | | 3,000 l. ft. | 5,000.00 |
| Ogdensburg | | | | | 18,225 | .21 |
| Olean | | | | | 3,000 | .18 |
| Oneonta | | | | | 18,792 | .133 |
| Port Chester | | | | | 3.600 | |
| Poughkeepsie | | | | | 40,715 | .25 |
| Rochester | | | | | 550,260 | .18 |
| Schenectady | | | | | 47,736 | 8,443.00 |
| Watertown | 6,150 | .90 | | | 25,000 | .25 |
| Waverly | | | 1 mi. | | | |
| **North Carolina** | | | | | | |
| Durham | | | | | 90,000 | 20,000.00 |
| Greensboro | | | | | 180,000 | .18 |
| Oxford | | | | | 33,300 | .18 |
| **North Dakota** | | | | | | |
| Grand Forks | | | | | 2,900 | .18 |
| Mandan | | | 35,000 | | | |
| Minot | | | 2,000 cu. yds. | 1.60 | 76,492 | 13,280.00 |
| Wahpeton | | | | | 500 | |

# WATERBOUND MACADAM AND GRAVEL PAVEMENTS

| | Waterbound Macadam | | Gravel | | Cement Sidewalks | |
|---|---|---|---|---|---|---|
| | Area sq. yd. | Cost | Area sq. yd. | Cost | Area sq. ft. | Cost |
| **Ohio** | | | | | | |
| Akron | ........ | ........ | ........ | ........ | 24.18 mi. | .19 |
| Ashtabula | ........ | ........ | ........ | ........ | 16,000 | .20 |
| Chillicothe | ........ | ........ | ........ | ........ | 4,500 | .16⅓ |
| Conneaut | ........ | ........ | ........ | ........ | 23,040 | ........ |
| E. Youngstown | ........ | ........ | ........ | ........ | 52,000 | 7,280.00 |
| Jackson | ........ | ........ | ........ | ........ | 4,500 | 900.00 |
| Marion | ........ | ........ | ........ | ........ | 13,170 | 2,610.00 |
| Middletown | ........ | ........ | ........ | ........ | 9,500 | 1,520.00 |
| Newark | ........ | ........ | ........ | ........ | 15,290 | 2,220.00 |
| Ravenna | ........ | ........ | 10,000 | .40 | 40,000 | .22 |
| Tiffin | 25,000 | ........ | ........ | ........ | ........ | ........ |
| Troy | ........ | ........ | 800 cu. yd. | .75 | 10,000 | .13 |
| Urbana | ........ | ........ | ........ | ........ | 20,000 | 3,600.00 |
| Warren | ........ | ........ | ........ | ........ | 23,414 l. ft. | .18-.22 |
| Washington | ........ | ........ | 2,280 | .70 | 4,500 | .18 |
| **Oklahoma** | | | | | | |
| Chickasha | ........ | ........ | ........ | ........ | 26,400 l. ft. | ........ |
| Muskogee | ........ | ........ | ........ | ........ | 18,000 | ........ |
| Norman | ........ | ........ | ........ | ........ | 2 mi. | .18 |
| Tulsa | ........ | ........ | ........ | ........ | 323,464 | .18 |
| **Oregon** | | | | | | |
| Ashland | ........ | ........ | ........ | ........ | 6,000 | 1,200.00 |
| Astoria | 1,397 | 1,043.00 | ........ | ........ | 61,814 | 12,981.00 |
| Dallas | ........ | ........ | ........ | ........ | 90,000 | .21 |
| Eugene | 6,000 | .60 | 3,000 | .45 | 4 mi. | .16 |
| Marshfield | ........ | ........ | ........ | ........ | 3,650 | .18 |
| Oregon City | 6,000 | .70 | ........ | ........ | 7,000 l. ft. | 1.00 |
| Portland | 1,307 | 17,529.00 | ........ | ........ | 204,561 | 36,821.00 |
| Salem | ........ | ........ | ........ | ........ | 157,680 | 13,654.00 |
| **Pennsylvania** | | | | | | |
| Berwick | ........ | ........ | ........ | ........ | 48,000 | .15 |
| Blairsville | ........ | ........ | ........ | ........ | 1,500 | .24 |
| College Hill | ........ | ........ | ........ | ........ | 1,098 | .33⅓ |
| Ellwood City | ........ | ........ | ........ | ........ | 31,000 | .18 |
| Freeland | ........ | ........ | 985 | 1,400.00 | 18,000 | 5,500.00 |
| Hanover | 14,000 ft. | ........ | ........ | ........ | 6,000 | ........ |
| Jersey Shore | 18,000 | 1.28 | ........ | ........ | 5,445 | .17 |
| Munhall | ........ | ........ | ........ | ........ | 12,400 | 3,000.00 |
| New Brighton | ........ | ........ | ........ | ........ | 2,750 | .27 |
| Norristown | 1,330 | 1.00 | ........ | ........ | ........ | ........ |
| Oil City | ........ | ........ | ........ | ........ | 2,898 | .25 |
| Royersford | 10,000 | ........ | ........ | ........ | ........ | ........ |
| Sharon | ........ | ........ | ........ | ........ | 2,237 l. ft. | 2,690.00 |
| Shippensburg | 22,222 | .63 | ........ | ........ | 8,000 | .15 |
| Somerset | ........ | ........ | ........ | ........ | 4,500 | .30 |
| Williamsport | ........ | ........ | ........ | ........ | 2.0 mi. | ........ |
| Woodlawn | ........ | ........ | ........ | ........ | 37,000 | .22 |
| **Rhode Island** | | | | | | |
| Cranston | 5,320 | 1.25½ | ........ | ........ | ........ | ........ |
| Pawtucket | ........ | ........ | ........ | ........ | 41,436 | ........ |
| **South Carolina** | | | | | | |
| Chester | ........ | ........ | 12,200 | 3,050.00 | 3,087 | 648.00 |
| Greenville | ........ | ........ | 8,000 | 8,000.00 | 177,795 | 26,669.00 |
| **South Dakota** | | | | | | |
| Mitchell | ........ | ........ | 1½ mi. | 3,700.00 | 5,000 l. ft. | 4,000.00 |
| Yankton | ........ | ........ | ........ | ........ | 1 mi. | .18 |
| **Tennessee** | | | | | | |
| Clarksville | 11,000 | .15[a] | ........ | ........ | ........ | ........ |
| Cleveland | ........ | ........ | ........ | ........ | 88,650 | 13,900.00 |
| Dyersburg | ........ | ........ | ........ | ........ | 10,000 | 1,250.00 |
| Jackson | ........ | ........ | 30,000 | 1.00 | 50,000 | .15 |
| Murfreesboro | 10,000 | | ........ | ........ | ........ | ........ |
| **Texas** | | | | | | |
| Bromwood | ........ | ........ | ........ | ........ | 10,000 l. ft. | 1.25 |
| Cameron | ........ | ........ | 100,000 | 1.10[a] | ........ | ........ |
| Cleburne | ........ | ........ | ........ | ........ | 2,000 | .20 |
| Denton | ........ | ........ | 27,050 | 1.25[1] | 54,000 | .09 |
| Eastland | ........ | ........ | ........ | ........ | 12,000 | .25 |
| Weatherford | ........ | ........ | 10,000 cu. yd. | .35 | 90,000 | .08⅓ |
| **Utah** | | | | | | |
| Brigham City | ........ | ........ | ........ | ........ | 20,576 | 3,086.00 |
| Logan | ........ | ........ | 12,469 | 2,130.00 | ........ | ........ |
| Provo | ........ | ........ | 55,000 | ........ | 126,000 | 20,000.00 |
| **Vermont** | | | | | | |
| Bennington | ........ | ........ | 3-4 mi. | ........ | 5,500 l. ft. | ........ |
| Rutland | 10,000 | .60 | 20,000 | .50 | 15,300 | .20 |
| **Washington** | | | | | | |
| Aberdeen | ........ | ........ | 6,475 | 10,027.00 | 75,825 | 12,638.00 |
| Mt. Vernon | ........ | ........ | 1,872 | .23 | 76,572 | .16 |
| Olympia | ........ | ........ | ........ | ........ | 10,984 | 14,154.00 |
| Pujallup | ........ | ........ | 2,945 l. ft. | 2,013.00 | 5,790 | 2,193.00 |
| Seattle | ........ | ........ | 35 mi. | ........ | 67,445 | ........ |
| Walla Walla | ........ | ........ | ........ | ........ | 15,000 | ........ |
| Yakima | ........ | ........ | ........ | ........ | 97,613 | 19,977.00 |
| **West Virginia** | | | | | | |
| Bluefield | ........ | ........ | ........ | ........ | 25,000 | 6,250.00 |
| Charleston | ........ | ........ | ........ | ........ | 300,000 | ........ |
| Clarksburg | ........ | ........ | ........ | ........ | 97,200 | 24,000.00 |
| Morgantown | 4,564 | 15,000.00 | ........ | ........ | ........ | ........ |
| **Wisconsin** | | | | | | |
| Beloit | ........ | ........ | ........ | ........ | 13,500 | ........ |
| Eau Claire | ........ | ........ | 10,000 | .90 | ........ | ........ |
| Green Bay | ........ | ........ | ........ | ........ | 10,200 | 2,572.00 |
| Kaukauna | ........ | ........ | ........ | ........ | 12,000 | ........ |
| Lake Geneva | ........ | ........ | 2,000 | 2,100.00 | 7,000 | 1,260.00 |
| Manitowoc | ........ | ........ | ........ | ........ | 2,000 l. ft. | .75 |
| Merrill | ........ | ........ | 52,000 | ........ | 46,000 | .09 |
| Marinette | ........ | ........ | ........ | ........ | 1,666 | .14 |

# WATERBOUND MACADAM AND GRAVEL PAVEMENTS

| | Waterbound Macadam | | Gravel | | Cement Sidewalks | |
|---|---|---|---|---|---|---|
| | Area sq. yd. | Cost | Area sq. yd. | Cost | Area sq. yd. | Cost |
| **Wisconsin** (Continued): | | | | | | |
| New London | ........ | ........ | ........ | ........ | 4,000 | ........ |
| Oshkosh | ........ | ........ | ........ | ........ | 3 mi. | 14,260.00 |
| Ripon | 9,000 | 3,150.00[m] | 3,000 | 460.00[m] | 800 | 96.00 |
| Sheboygan | ........ | ........ | ........ | ........ | 55,829 | 9,789.00 |
| Tomahawk | ........ | ........ | 1,935 | 1.75 | ........ | ........ |
| Wausau | ........ | ........ | ........ | ........ | 158.400 | .15 |
| Wisconsin Rapids | ........ | ........ | ........ | ........ | 27,000 | .11 |
| **Wyoming** | | | | | | |
| Casper | ........ | ........ | ........ | ........ | 124.468 | .20 |
| Sheridan | ........ | ........ | ........ | ........ | 26,142 | .25 |

[a] Surface only. [c] Surface and grading. [g] Surface, curb and gutter. [k] 2,000 yds. with grading and curb. 4.000 yds. without curb. [l] Treated with asphaltic oil or tarvia. [m] Includes grading, curb, raising manholes and building catch-basins. [n] Per lineal foot, including curb and gutter.

# ROAD WORK CONTEMPLATED FOR 1923

| County | Kind and Amount of Work |
|---|---|
| **Arkansas:** | |
| Hempstead | $45,000—2.7 mi. conc. or asph. rd. |
| **Colorado:** | |
| Cheyenne | 50,000—30 mi grading—7 mi. state road |
| La Plata | 130,000—8 mi. gravel surf., incl. grad. and 30 mi. grad.; maint., $25,000 |
| **Connecticut:** | |
| Fairfield | ........—2 mi. gravel |
| **Florida:** | |
| Broward | 200,000—Chiefly asphalt surface |
| Glades | 32,000—Ap. 8 mi. plain macadam |
| Pinellas | 2,863,030—Vit. br., conc., asph. blk., sh. asph. or bit. mac. |
| St. Lucie | 310,000—8 mi. bit. mac., 26 mi. W. B. mac., surf. treat. |
| **Illinois:** | |
| Bond | 50,000—Complete last year's contracts and grading |
| Henderson | 15,000—Bridges |
| Schuyler | 500,000—15 mi. cement concrete, 120 earth maintenance |
| **Indiana:** | |
| Tippecanoe | 500,000—14 mi. gravel—6 mi. Em. asphalt |
| Vermillion | ........—7½ mi. concrete |
| **Iowa:** | |
| Dubuque | 250,000—18.2 mi. grad., incl. 40,000 cu. yd. solid rock |
| **Kansas:** | |
| Anderson | 300,000—Grade all earth roads; 13 mi. gravel roads |
| Seward | 40,000—Clay surf, 8½ mi.; Blade, 11 mi.; 4 mi. Fresno |
| **Louisiana** | |
| Vernon | ........—Ap. 40 mi. gravel |
| **Michigan:** | |
| Genesee | 565,403—39 mi. grav., 1½ mi. paving |
| **Minnesota:** | |
| Red Lake | 159,000—25 mi. grad., bridges and culv., 3½ mi. gravel |
| Winona | 100,000—15 mi. grading, 15 mi. gravel, 30 mi. blading |
| **Montana:** | |
| Gallatin, Park, Madison, Broadwater, Jefferson | Ap. 300,000—Grad., drain and gravel surfacing |
| **Nebraska:** | |
| Cheyenne | 80,000—12 mi. Federal |
| Grant | 18,000—Grading, dirt surfacing |
| Lancaster | 900,000—Earth work and bridge construction |
| Morrill | 140,000—8 mi. gravel and clay surfacing |
| Sioux | 20,000—Grading and maintenance |
| **New Jersey:** | |
| Burlington | 175,000—Ap. 15 mi. sheet asphalt |
| Mercer | 500,000—100.000 sq. yd. bit. mac., 50,000 sq. yd reinf. conc., 2,500 sq. yd. sh. asph., 2,000 sq. yd. brick, 4,500 sq. yd. granite |
| **New Mexico:** | |
| Dona Ana | ........—18 mi. gravel surfacing |
| **New York:** | |
| Broome | 150,000—15 mi. top on 1922 base, Tarvia-bound; will lay more base |
| Essex | 2,000—Grade and gravel |
| Genessee | 14,500—¾ mi. mac., 1½ mi. co. rd.; final course of 4" oil penetration |
| Lewis | 320,457—19.3 mi. bit. mac., 0.5 mi. conc. |
| Livingston | ........—1 mi. crown and gravel; ap. 5 mi. gravel resurface |
| Montgomery | 8,000—¼ mi. mac., 1 mi. resurface; remainder earth road |
| Oneida | 117,088—2 mi. bit. macadam |
| Orleans | Ap. 150,000—Bit. macadam |
| Warren | 206,811—5 mi. bit. macadam |
| Washington | 140,000—Gravel and macadam |
| Yates | 324,000—Bit. macadam |
| **North Dakota:** | |
| Adams | 12,000—Grading |
| Divide | Ap. 30,000—12 mi. state rd.; gravel, 12; 18 mi. of earth rd. |
| Foster | ........—11 mi. grading. |
| **Oklahoma:** | |
| Caddo | 142,429—Grading, gravel, clay |
| **South Carolina:** | |
| Orangeburg | 130,000—Sand-clay rd., conc. rd. |
| **South Dakota:** | |
| Clay | 55,000—36 mi. grad., 22 mi. gravel |
| **Texas:** | |
| Carson | 12,000—Ap. 75 mi. grading |
| Somerville | 175,000—30 mi. gravel on surfaced roads |
| Washington | 835,000—39 mi. grading and drainage structures |
| **Washington:** | |
| Island | 50,000—2 mi. grad. and gravel |
| Spokane | 750,000—........ |
| **Wisconsin:** | |
| Trumpealeau | 300,000—Grading, shale and gravel surface; culv. and bridges |

# ROAD IMPROVEMENT DONE IN 1922

| County | Bit. Macadam (M) and Bit. Concrete (C) Amount Miles or Sq. Yds. | Total Cost | Cement Concrete (R = Reinforced) Amount Miles or Sq. Yds. | Total Cost | Plain Macadam Amount Miles or Sq. Yds. | Total Cost |
|---|---|---|---|---|---|---|
| **Florida:** | | | | | | |
| Glades | ...... | ...... | ...... | ...... | 25 | $94,850.00 |
| Broward | 60,000 M | $0.54 | ...... | ...... | 70,000 | 0.42 |
| Pinellas | ...... | ...... | ...... | ...... | 10 | 50,000.00 |
| St. Lucie | ...... | ...... | ...... | ...... | 24 | 138,000.00 |
| **Illinois:** | | | | | | |
| Bond | ...... | ...... | 5 R | $90,000.00 | ...... | ...... |
| Schuyler | ...... | ...... | 3,000 ft. R | 15,000.00 | ...... | ...... |
| **Montana:** | | | | | | |
| Gallatin, Park, Madison, Broadwater, Meagher, | 1.0 C | 33,000.00 | ...... | ...... | ...... | ...... |
| Jefferson | 5.5 M | 22,000.00 | ...... | ...... | ...... | ...... |

## ROAD IMPROVEMENT DONE IN 1922

| County | Bit. Macadam (M) and Bit Concrete (C) Amount Miles or Sq. Yds. | Total Cost | Cement Concrete (R = Reinforced) Amount Miles or Sq. Yds. | Total Cost | Plain Macadam Amount Miles or Sq. Yds. | Total Cost |
|---|---|---|---|---|---|---|
| **New Jersey:** | | | | | | |
| Cumberland | ...... | ...... | 1.10 R | 43,000.00 | ...... | ...... |
| Mercer | 28,934 M | 1.80 | 92,835 R | 3.31 | ...... | ...... |
| **New Mexico** | | | | | | |
| Dona Ana | ...... | ...... | 10.4 | 205,800.00 | ...... | ...... |
| **New York:** | | | | | | |
| Broome | 5 M | ...... | ...... | ...... | ...... | ...... |
| Genesee | ...... | ...... | ...... | ...... | 1½ | 16,300.00 |
| Lewis | 18.5 M | 7.950.00 | ...... | ...... | 2½ | 1,789.00 |
| Orleans | 3.75 M | 58,000.00 | ...... | ...... | ...... | ...... |
| Warren | 4.31 M | 75,591.00 | ...... | ...... | ...... | ...... |
| Washington | 1 M | 16,000.00 | ...... | ...... | 5 | 9,000.00 |
| Yates | 4.62 M | 188,000.00 | 7.07 R | 346,000.00 | ...... | ...... |
| **Oklahoma:** | | | | | | |
| Atoka | ...... | ...... | 48 cu. yd. R | 1,020.00 | 6 | 26,200.00 |
| Caddo | ...... | ...... | ...... | 58,714.00 | ...... | ...... |
| **South Carolina:** | | | | | | |
| Orangeburg | ...... | ...... | 3 | 55,000.00 | ...... | ...... |
| **Texas:** | | | | | | |
| Washington | ...... | ...... | 32 R | 864,000.00 | ...... | ...... |
| **Washington:** | | | | | | |
| Spokane | ...... | ...... | 14.12 | 435,000.00 | 97.27 | 621,930.00 |

## ROAD IMPROVEMENT DONE IN 1922

| County | Grading Amount Mi. or Sq.Yds. | Cost | Earth Surfacing Amount Mi. or Sq.Yd. | Cost | Gravel Amount Mi. or Sq. Yd. | Cost | Culverts & Bridges Included in Cost |
|---|---|---|---|---|---|---|---|
| **Arkansas:** | | | | | | | |
| Hempstead | 20,000 | $0.30 | 12 | $4,000.00 | 19 | $152,000.00 | 40 br. & culv. |
| **Colorado:** | | | | | | | |
| Cheyenne | 148 | ...... | 253 | ...... | 29 | ...... | 4 br., 40 culv. |
| La Plata | 50 | 50,000.00 | .... | ...... | 12.5 | 80,000.00 | $23,000 for br. & culv. |
| **Florida:** | | | | | | | |
| Broward | 90,000 cu. yd. | 0.81 | .... | ...... | .... | ...... | No |
| Glades | 29 | 33.650.00 | .... | ...... | .... | ...... | No |
| Pinellas | 40 | 24.000.00 | .... | ...... | .... | ...... | No |
| St. Lucie | 24 | 12,000.00 | .... | ...... | .... | ...... | No |
| **Illinois:** | | | | | | | |
| Bond | 60 | 10,000.00 | .... | ...... | .... | ...... | ........ |
| Schuyler | 125 | 85,000.00 | .... | ...... | .... | ...... | 60 culv. & br. |
| **Indiana:** | | | | | | | |
| Tippecanoe | .... | ...... | .... | ...... | 16 | ...... | ........ |
| Vermillion | .... | ...... | .... | ...... | 3 | 5,000.00 | ........ |
| **Iowa:** | | | | | | | |
| Dubuque | 60,000 | 29,000.00 | .... | ...... | 2 | 6,000.00 | No |
| **Kansas:** | | | | | | | |
| Anderson | 30 | 10,000.00 | 100 | 6,000.00 | 8½ | 107,000.00 | Yes |
| Seward | 3 | 150.00 | 1½ | 0.50s | .... | ...... | No |
| **Louisiana** | | | | | | | |
| Vernon | 170,000 cu. yd. | 37,000.00 | .... | ...... | 20 | 60,000.00 | No |
| **Michigan:** | | | | | | | |
| Genesee | .... | ...... | .... | ...... | 48 | 408,000.00 | Yes |
| **Minnesota:** | | | | | | | |
| Red Lake | 30 | 60.000.00 | 11½ | 11,000.00 | 18½ | 36.500.00 | 12 br., 29 culv. |
| Winona | 20 | 25,000.00 | 14 | 2,800.00 | 5 | 4,500.00 | No |
| **Montana:** | | | | | | | |
| Custer | 70 | 14,000.00 | .... | ...... | 9 | 7,200.00 | 280 culv., $16,800 |
| Gallatin, Park, Madison, Broadwater, Jefferson | 90 | 360,000.00 | .... | ...... | 60 | 180,000.00 | Yes |
| Treasure | .... | 488.00 | .... | ...... | .... | ...... | New br., $678 |
| **Nebraska:** | | | | | | | |
| Cheyenne | 200 | 20,000.00 | .... | ...... | .... | ...... | No |
| Gosper | 12 | 5,000.00 | 75 | 5,000.00 | .... | ...... | No |
| Grant | 10 | 200.00 | 15 | 300.00 | .... | ...... | No |
| Hamilton | 60 | 5,000.00 | .... | ...... | .... | ...... | No |
| Lancaster | 500 | 100,000.00 | .... | ...... | .... | ...... | ........ |
| Morrill | 3 | ...... | 3 | 10,000.00 | 11 | 22,000.00 | No |
| Sioux | 32 | 6,400.00 | .... | ...... | .... | ...... | No |
| **New Jersey:** | | | | | | | |
| Cumberland | .... | ...... | .... | ...... | 6½ | 49,000.00 | Yes |
| **New Mexico:** | | | | | | | |
| Dona Ana | 41,600 cu. yd. | 12,500.00 | 10 | 2.300.00 | 20 | 40,000.00 | All small culverts |
| **New York:** | | | | | | | |
| Essex | 47 | ...... | .... | ...... | 9 | ...... | No |
| Washington | 25 | ...... | .... | ...... | 15½ | 6,000.00 | Yes |
| **North Dakota:** | | | | | | | |
| Adams | 118 | 9,000.00 | .... | ...... | .... | ...... | 70 culverts |
| Divide | 20 | 54,180.00 | .... | ...... | .... | ...... | $5,784 |
| Foster | .... | ...... | .... | ...... | 10 | 26,000.00 | No |
| **Oklahoma:** | | | | | | | |
| Atoka | 6 | 6,500.00 | .... | ...... | .... | ...... | Yes |
| Caddo | .... | 24,478.00 | .... | ...... | .... | ...... | 104, cost, $84,985 |
| Coal | 13 | 10,300.00 | .... | ...... | .... | ...... | |
| **South Carolina:** | | | | | | | |
| Orangeburg | .... | 28c-32c | .... | ...... | .... | ...... | All culv. 36" or less |
| **South Dakota:** | | | | | | | |
| Clay | 47.5 | 26,702.00 | .... | ...... | 13.03 | 42,179.00 | ........ |
| **Texas:** | | | | | | | |
| Carson | 75 | 50.00 | .... | ...... | .... | ...... | ........ |
| Somerville | .... | ...... | 4 | 300.00m | 4 | 9,400.00m | Yes |
| Washington | 32 | 98,000.00 | 32 | 7.000.00 | .... | ...... | No |
| **Washington:** | | | | 25,000.00 | | | |
| Island | .... | ...... | .... | ...... | 5 | 4,000.00 | No |
| **Wisconsin:** | | | | | | | |
| Trempealeau | 30 | 125,000.00 | 15 | ...... | 15 | 70,000.00 | No |

m—per mile. s—per yard.

# REINFORCEMENT AND RESURFACING

| County | Reforcement Used in Concrete Roads | Materials Used in Resurfacing — Concrete Pavements | Brick Pavements | Macadam and Gravel |
|---|---|---|---|---|
| **Arizona:** | | | | |
| Maricopa | .......... | .......... | .......... | Asph. concr. 1½" to 2" |
| Pinal | .......... | .......... | .......... | Caliche and disintegrated granite |
| **Arkansas:** | | | | |
| Hempstead | 35 lb. per 100 sq. ft. | .......... | .......... | .......... |
| **Colorado:** | | | | |
| Mesa | .......... | Tarvia | .......... | .......... |
| **Delaware:** | | | | |
| New Castle | .......... | .......... | .......... | Bit. concr. or macadam |
| **Florida:** | | | | |
| Broward | .......... | .......... | .......... | Asph. oil and sand |
| **Illinois:** | | | | |
| Bond | ¾ round bars | .......... | .......... | .......... |
| Fulton | State standards | Asphalt | Asphalt | .......... |
| Green | State standards | .......... | .......... | .......... |
| Kane | State specifications | .......... | .......... | .......... |
| Mason | State specifications | .......... | .......... | .......... |
| Peoria | Bars along edge | Tarvia | .......... | .......... |
| Sangamon | ½" bars on edge | .......... | .......... | .......... |
| Schuyler | Illinois specifications | .......... | .......... | .......... |
| Stephenson | ¾" bar along each edge | .......... | .......... | .......... |
| Whiteside | ¾" bars | .......... | .......... | .......... |
| Will | Mild steel bars | .......... | .......... | .......... |
| Williamson | ¾" bars on both edges | .......... | .......... | Gravel, asphalt, cold patch. |
| Winnebago | .......... | .......... | .......... | Refined tar for macadam |
| **Indiana:** | | | | |
| Tippecanoe | .......... | .......... | Tarvia | Gravel |
| Vigo | .......... | Emulsified asphalt | Emulsified asphalt | .......... |
| **Iowa:** | | | | |
| Buchanan | ½" square bars | .......... | .......... | .......... |
| Des Moines | ½" square bars | .......... | .......... | .......... |
| Dickinson | .......... | .......... | .......... | Concrete |
| Greene | .......... | Tarvia | .......... | .......... |
| Kossuth | ½" square bars | .......... | .......... | .......... |
| Woodbury | ½" square bars | .......... | .......... | .......... |
| **Kansas:** | | | | |
| Allen | .......... | .......... | .......... | Concrete and bitumen. |
| Barber | .......... | .......... | .......... | Clay and gravel |
| Bourbon | .......... | .......... | .......... | Bitumin. surface treat. |
| Reno | ½" and ¾" bars | Asphalt | Asphalt | .......... |
| Seward | .......... | .......... | .......... | Clay |
| **Kentucky:** | | | | |
| Rockcastle | .......... | .......... | .......... | Cold patch and new rock or gravel |
| Whitley | 40 lbs. | Ky. rock asphalt | Ky. rock asphalt | .......... |
| **Louisiana:** | | | | |
| Caddo | .......... | .......... | .......... | Heavy asphaltic oil |
| Lincoln | .......... | .......... | .......... | Sand-clay gravel |
| **Michigan:** | | | | |
| Branch | 5' bars, 6¼' centers, with center joint | .......... | Sheet asphalt in city | Cold tar and asphalt |
| Charlevoix | .......... | .......... | .......... | ¼" chips and tarvia |
| Chippewa | .......... | .......... | .......... | Cold patch tar and pea gravel |
| Delta | .......... | .......... | .......... | Surface treatment |
| Emmet | .......... | .......... | .......... | Tarvia A & crushed rock |
| Genesee | 80 lb. | .......... | .......... | .......... |
| Kalamazoo | .......... | .......... | .......... | Tar and asphalt |
| Kent | ¾" bars, circumferential | .......... | .......... | .......... |
| Luce | .......... | .......... | .......... | Asphalt and refined tars |
| Muskegon | ¾" side bars, ⅝" cross bars | .......... | .......... | Asphaltic macadam |
| Ottawa | Center plate, ¾" rods | .......... | .......... | .......... |
| St. Joseph | .......... | .......... | .......... | Gravel and tarvia |
| **Minnesota:** | | | | |
| Mille Lacs | .......... | .......... | .......... | Clay and gravel |
| **Nebraska:** | | | | |
| Lancaster | .......... | .......... | Sheet asphalt | .......... |
| **New Mexico:** | | | | |
| Dona Ana | .......... | Asphaltum | .......... | Gravel |
| **New York:** | | | | |
| Broome | .......... | .......... | .......... | Tarvia |
| Lewis | .......... | .......... | .......... | Bit. macadam |
| Oneida | .......... | .......... | .......... | Tarvia |
| Warren | N. Y. State standards | Bit. macadam | .......... | Bit. macadam |
| Yates | 5 lbs. | .......... | .......... | Concrete top in some cases |
| **Ohio:** | | | | |
| Allen | 71 lb. mesh | Ky. rock or bit. concr. | Relay brick | Oil or asph. surface treat. |
| Ashtabula | Kind not determined | .......... | .......... | Tar or asph. surface treat. |
| Ashland | ½" bars | .......... | New brick or asphalt | .......... |
| Carroll | .......... | .......... | .......... | Bit. material M. T. |
| Clark | .......... | A1 and T1 | .......... | A1 and T1 |
| Fairfield | Rods | .......... | .......... | .......... |
| Hancock | Illinois standard | .......... | .......... | Tar and asphalt |
| Harrison | .......... | Tar patch | .......... | Blast furnace slag |
| Henry | Mesh 56 lb. | .......... | .......... | Stone and tar |
| Holmes | .......... | .......... | Tar | .......... |
| Lucas | 40 lb. and 56 lb. | .......... | .......... | Stone and tar |
| Medina | ¼" sq. deformed, 6" centers | New concrete | Concrete | .......... |
| Paulding | ½" | .......... | .......... | .......... |
| Putnam | .......... | .......... | .......... | M T tar & No. 6 stone |
| Richland | ⅜" rods, 5½ lb. per sq. yd. | .......... | Rock asphalt | Tar and asphalt |
| Ross | .......... | Asphaltic materials | Brick | Cut-back |
| Trumbull | Rods | Asphaltic concrete | .......... | Tar & asph. surface treat. |
| Van Wert | ⅝" round rods | .......... | .......... | .......... |

## REINFORCEMENT AND RESURFACING

| County | Reforcement Used in Concrete Roads | Materials Used in Resurfacing: Concrete Pavements | Brick Pavements | Macadam and Gravel |
|---|---|---|---|---|
| **Oklahoma:** | | | | |
| Beaver | ½" sq. and ¾" round bars | Tarvia A and B | .......... | Tarvia A and gravel |
| Creek | Bates section | Asphalt | .......... | .......... |
| McIntosh | .......... | .......... | .......... | Camden asphaltic oil |
| Tillman | Kind not decided | .......... | .......... | .......... |
| **Tennessee:** | | | | |
| Johnson | .......... | .......... | .......... | Tarvia |
| **Texas:** | | | | |
| Cameron | Bars, 4 lb. per sq. yd. | .......... | .......... | .......... |
| El Paso | Asphalt | .......... | .......... | Asphalt or gravel |
| Fannin | Illinois state standards | .......... | .......... | Invert. penetra., topping, 1" |
| Harris | .......... | Asphalt | .......... | Shell |
| Hidalgo | ¼" bars every 18" each way | .......... | .......... | Rock asphalt |
| Kaufman | ½" sq. bars | .......... | .......... | Bitumen |
| Palo Pinto | .......... | .......... | .......... | Asphalt |
| Rockwall | One ⅝" round each side | .......... | .......... | .......... |
| Smith | ¾" bars | .......... | .......... | .......... |
| Washington | .......... | Refined tar | | .......... |
| **Virginia:** | | | | |
| Albermarle | .......... | .......... | .......... | Bit. penetration mac. |
| Augusta | .......... | .......... | .......... | Tar and asphalt |
| Pittsylvania | .......... | .......... | .......... | Tarvia & ¾" lime. chips |
| Tazewell | .......... | .......... | .......... | Bitumen & crushed limest. |
| **Washington:** | | | | |
| Clarke | .......... | Asphaltic concrete | .......... | Clay and rock |
| Pierce | .......... | Asphaltic concrete | .......... | .......... |
| Skagit | ½" bar | Concrete | .......... | .......... |
| Whatcom | .......... | Asphalt | .......... | .......... |
| Whitman | Steel bars | .......... | .......... | .......... |
| **West Virginia:** | | | | |
| Mineral | .......... | .......... | Reconstruct subgrade and replace brick | Limestone & cold tar |
| Upshur | .......... | .......... | Asphalt | .......... |
| Wood | Mesh 65 lbs. | Tarvia K. P. or equal | Asphalt | .......... |
| **Wisconsin:** | | | | |
| Fond du Lac | ½" rods, 4' centers trans. | .......... | .......... | .......... |
| Forest | 85 lbs. | .......... | .......... | .......... |
| Jefferson | ½" bars | .......... | .......... | .......... |
| Juneau | Mesh | Oil and chips | .......... | .......... |
| Lacrosse | .......... | Tar | .......... | Tar |
| Richland | ½" sq. bars | .......... | .......... | .......... |
| Sheboygan | ½" bars every 4 ft. | .......... | .......... | .......... |
| Trempealeau | ½" | .......... | .......... | .......... |
| Vernon | Mesh | .......... | .......... | Tarvia and gravel |
| Walworth | ½" sq. & ⅝" sq. bars | .......... | .......... | .......... |
| Waushara | .......... | .......... | .......... | Clay and gravel |

## TOTAL COUNTY, STATE AND FEDERAL FUNDS

| County and State | Spent in 1922 | Available for 1923 |
|---|---|---|
| **Arkansas:** | | |
| Hempstead | $172,000 | $45,000 |
| **Colorado:** | | |
| Cheyenne | 81,193 | 50,000 |
| La Plata | 152,000 | 185,000 |
| **Florida:** | | |
| Broward | 350,000 | 200,000 |
| Pinellas | 50,000 | ...... |
| St. Lucie | 150,000 | 310,000 |
| Glades | 140,500 | 32,000 |
| **Illinois:** | | |
| Bond | 100,000 | 50,000 |
| Henderson | 25,000[a] | 15,000 |
| Schuyler | 100,000 | 500,000 |
| **Indiana:** | | |
| Tippecanoe | ap. 320,000 | 500,000 |
| **Iowa:** | | |
| Dubuque | 200,000 | 250,000 |
| **Kansas:** | | |
| Anderson | 266,000 | 300,000 |
| Seward | 12,000 | 40,000 |
| **Louisiana:** | | |
| Vernon | 133,000 | ...... |
| **Michigan:** | | |
| Genesee | ap. 800,000 | 565,403 |
| **Minnesota:** | | |
| Red Lake | 147,833[g] | 159,000 |
| Winona | 100,000 | 100,000 |
| **Montana:** | | |
| Custer | 62,000[a] | 200,000 |
| Gallatin, Park, Madison, Meagher, Broadwater and Jefferson | ap. 1,000,000 | ap. 300,000 |
| Sheridan | 48,092 | 14,000 |
| Treasure | 1,935[c] | 11,000 |
| **Nebraska:** | | |
| Cheyenne | 50,000 | 80,000 |
| Gosper | 55,000 | ...... |
| Grant | ...... | 18,000 |
| Hamilton | 60,000 | ...... |
| Lancaster | 350,000 | 900,000 |
| Morrill | 32,000 | 140,000 |
| Nance | 65,000[a] | 45,000 |
| Sioux | 21,000 | 20,000 |
| **New Jersey:** | | |
| Burlington | 315,000 | 175,000 |
| Mercer | ...... | 500,000 |
| **New Mexico:** | | |
| Don Ana | 260,000 | ...... |
| **New York:** | | |
| Broome | 160,000 | 150,000 |
| Essex | 18,000[f] | 2,000 |
| Genesee | 16,000 | 14,500 |
| Lewis | 250,918 | 320,457 |
| Montgomery | ...... | 8,000 |
| Oneida | ap. 116,000 | 117,088 |
| Orleans | ap. 71,000[a] | ap. 150,000[a] |
| Warren | 200,000 | 206,811 |
| Washington | ap. 120,000[a] | 140,000[a] |
| Yates | 534,000 | 324,000 |
| **North Dakota:** | | |
| Adams | ap. 13,000 | 12,000 |
| Divide | 60,000 | ap. 30,000 |
| Foster | 26,000 | ...... |
| **Oklahoma:** | | |
| Atoka | 58,000 | 26,500 |
| Caddo | 168,127 | 142,429 |
| Coal | 47,000 | 36,030 |
| **South Carolina:** | | |
| Orangeburg | ap. 300,000 | 130,000 |
| **South Dakota:** | | |
| Clay | 70,343 | 55,000 |
| **Texas:** | | |
| Carson | 15,000 | 12,000 |
| Somerville | 50,000 | 175,000 |
| Washington | 1,212,000 | 835,000 |
| **Washington:** | | |
| Island | 52,000 | 50,000 |
| Spokane | 1,056,930[f] | 750,000 |
| **Wisconsin:** | | |
| Trempealeau | 275,000 | 300,000 |

[a]—county funds only. [c]—on bridges. [f]—county and state aid. [g]—does not include money spent by state on trunk roads

## ROAD IMPROVEMENT DONE IN 1922

| County | Kind | Amount | Cost |
|---|---|---|---|
| **Arizona:** | | | |
| Pinal | Bridges and culverts | ...... | $9,225 |
| Yuma | Structures | 50 | 20,000 |
| | Maintenance | 500 mi. | 45,000 |
| **Arkansas:** | | | |
| Pike | Bridge | 1 | 30,000 |
| **Connecticut** (Towns): | | | |
| Windsor | Plain macadam | 1 mi. | 6,500 |
| **Delaware:** | | | |
| New Castle | Concrete and bit. concrete | 10.8 mi. | 317,000 |
| | Maintenance and repair | ...... | 102,285 |
| | Bridges | ...... | 74,000 |
| | Bridge maintenance | ...... | 40,000 |
| **Florida:** | | | |
| Broward | Plain macadam | 70,000 sq yds. | 42 cts. |
| Glades | Plain macadam | 25 mi. | 94,850 |
| Pinellas | Plain macadam | 10 mi. | 50,000 |
| St. Lucie | Bit. surface treatment | 5 mi. | 25,000 |
| | Plain macadam | 24 mi. | 138,000 |
| **Illinois:** | | | |
| Macoupin | Bridges | ...... | 18,700 |
| | State aid road work | ...... | 17,850 |
| Peoria | Oiling | 120 mi. | 45,000 |
| | Maintain dirt road | 174 mi. | 36,000 |
| Stark | Maintenance | 10 mi. | 1,000 |
| Will | State aid repairs | 200 mi. | 22,447 |
| Woodford | Oil testing earth roads | 36 mi. | 10,717 |
| | Patrol | 25 mi. | 1,144 |
| | Culverts | 37 | 12,483 |
| **Indiana:** | | | |
| Jennings | Plain macadam | 14.33 mi. | 100,357 |
| Shelby | Plain macadam | 9.25 mi. | 6,030 per mi. |
| Tippecanoe | Em. asphalt | 1 mi. | ...... |
| **Iowa:** | | | |
| Adams | Bridges | 90 | 89,626 |
| | Maintenance | 140 mi. | 32,805 |
| Appanoose | Concrete bridges and culverts | 34 | 70,000 |
| Benton | Bridge | 1 | 75,000 |
| Buchanan | Maintenance | 183 mi. | 50,000 |
| | Bridges and culverts | ...... | 64,000 |
| Clay | Bridges and culverts | ...... | 50,000 |
| Hamilton | Bridges | 6 | 40,000 |
| | Culverts | 40 | 100,000 |
| Lucas | Bridge, culv. and maintenance | ...... | 40,000 |
| Mitchell | Concrete bridges | 74 | 85,000 |
| | Tile drainage | 13 mi. | 25,000 |
| | Maintenance | 83 mi. | 41,000 |
| Poweshiek | Reinf. cover. bridges | ...... | 60,000 |
| Wapello | Bridges and culverts | 63 | 44,000 |
| Worth | Bridges and culverts | ...... | 25,000 |
| **Kansas:** | | | |
| Allen | Bit. surface on macadam | 4½ mi. | 13,350 |
| Cowley | Plain macadam | 3 mi. | 6,700 per mi. |
| Crawford | Chat road | 16 mi. | 6,000 per mi. |
| Ellis | Maintenance | ...... | 8,926 |
| | Dragging | ...... | 5,564 |
| Jackson | Bridges | 43 | 42,350 |
| | Maintenance | ...... | 15,000 |
| Kingman | Maintenance | ...... | 25,000 |
| | Concrete bridges | ...... | 45,000 |
| Lincoln | Grading and maintenance | ...... | 35,000 |
| Lyon | Culverts and repairs | ...... | 50,000 |
| Seward | Earth | 2 mi. | ...... |
| **Kentucky:** | | | |
| Boyle | Plain macadam | 2 mi. | 12,000 |
| Fleming | Plain macadam, 12 ft. | 0.4 mi. | 1,600 |
| | Maintenance | ...... | 37,500 |
| Gallatin | Maintenance | 152 mi. | 11,368 |
| Jefferson | Plain macadam | 6 mi. | 60,000 |
| | Concrete bridge | 1 | 38,250 |

## ROAD IMPROVEMENT DONE IN 1922— (Continued)

| County | Kind | Amount | Cost |
|---|---|---|---|
| **Ohio**—Continued | | | |
| Lucas | Plain macadam | 108,783 sq. yd. | 164,262 |
| | Willite | 22,818 sq. yd. | 114,090 |
| Madison | Gravel, repair | 80 mi. | 83,364 |
| | Plain macadam, repair | 5 mi. | 10,000 |
| Marion | Plain macadam | 8 mi. | 54,894 |
| | Maintenance | ...... | 150,000 |
| Paulding | Plain macadam | 15 mi. | 117,000 |
| Putnam | Plain macadam | 12 mi. | 96,000 |
| | Kentucky rock asphalt | 11 mi. | 231,000 |
| Richland | Plain macadam | 5 mi. | 60,000 |
| | Maintenance of macadam | ...... | 55,000 |
| Ross | Bridges | ...... | 75,000 |
| Sandusky | Plain macadam | 2 mi. | 12,000 |
| Van Wert | Plain macadam | 4 mi. | 12,000 |
| **Oklahoma:** | | | |
| Atoka | Plain macadam | 6 mi. | 26,200 |
| McIntosh | Culverts on 12 mi. of road | ...... | 4,100 |
| Texas | Concrete bridges | ...... | 43,000 |
| Tillman | Concrete structures | 665 cu. yd. | 15,012 |
| **South Carolina:** | | | |
| Greenwood | Top soil surfacing | 8.9 mi. | 25,543 |
| Orangeburg | Sand-clay | 150 mi. | 3,200 per mi. |
| **South Dakota:** | | | |
| Denel | Reinforced concrete culvert | 132 cu. yd. | 2,141 |
| **Tennessee:** | | | |
| Clay | Bridge | 1 | 4,000 |
| **Texas:** | | | |
| Harris | Plain macadam | 4 mi. | 48,000 |
| | Maintenance | ...... | 264,000 |
| Kames | Rock asphalt, 1" | 150,000 sq. yd. | 90,000 |
| Shelby | Culverts, 18" to 36" C.M. pipe | 1,600 ft. | 4,000 |
| | Timber bridges | 15 = 360 ft. | 4,300 |
| Smith | Gravel treated with asphalt | 5 mi. | 1,250 |
| Somerville | Maintenance and bridges | ...... | 11,400 |
| Wise | Sand-clay | 252 cu. yd. | 1,400 |
| | Culverts | 500 cu. yd. | 11,785 |
| **Virginia:** | | | |
| Augusta | Plain macadam | 5 mi. | 27,500 |
| | Loose macadam | 1¾ mi. | 7,700 |
| | Cement culverts | 5 | 2,000 |
| Pittsylvania | Maintenance, soil roads | 100 mi. | 30,000 |
| Tazewell | Plain macadam | 9 mi. | 45,000 |
| | Maintenance | 20 mi. | 17,000 |
| | Repair work | ...... | 30,000 |
| **Washington:** | | | |
| Grays Harbor | Bridges | 10 | 38,000 |
| Jefferson | Maintenance | ...... | 46,000 |
| **West Virginia:** | | | |
| Berkeley | Plain macadam | 25 mi. | 25,000 |
| | Asphalt (by state) | 5 mi. | 100,000 |
| Boone | Maintenance | ...... | 20,000 |
| Mineral | Plain macadam | 2 mi. | 20,000 |
| | Shale | 12 mi. | 40,000 |
| | Maintenance | ...... | 20,000 |
| Wood | Maintenance, earth roads | 800 mi. | 71,180 |
| **Wisconsin:** | | | |
| Florence | 1 bridge and 14 culverts | ...... | 8,200 |
| | Engineering and inspection | ...... | 3,296 |
| | Patrol | ...... | 9,000 |
| | Machinery | ...... | 10,000 |
| Fond du Lac | Culverts and bridges | 15 mi. | 11,026 |
| Jackson | Shale | 11¼ | 18,122 |
| Juneau | Bridges | 5 | 10,600 |
| | Maintenance | 86.9 mi. | 22,600 |
| Richland | Plain macadam | 1 mi. | 4,832 |
| | Shale | 4 mi. | 9,063 |
| Sauk | Plain macadam | 3 mi. | 20,000 |
| Vernon | Guard rail | ...... | 10,000 |
| | Maintenance | ...... | 113,600 |
| Walworth | Maintenance, county roads | 283 mi | 68,593 |

# HIGHWAY WORK CONTEMPLATED FOR 1923

**Continued from the April Issue, Page 146.**

County. Kind and Amount of Work.

**Texas—Continued**

Palo Pinto....50 mi. bit. topped macadam
Red River....Gravel surface state highways, concrete drainage structures—$250,000
Rockwall .....12 mi. single track concrete.
Runnels ......10 mi. earth grading with conc. structures
Schleicher ....9.86 mi. bit. macadam, including concrete drainage structures.
Shelby .......60 mi. sand-clay, 20 mi. gravel.
Smith ........30 mi. gravel, 7 mi. bit. surface macadam, 4 mi. concrete.
Somerville ....30 mi. gravel surfacing.
Tom Green....15 mi. bit. surface on waterbound mac.
Uvalde .......25 mi. bit. top, 60 mi. gravel, grading, drainage structures.
Washington ..29 mi. grading, drainage structures.
Wise .........1 mi. gravel and macadam—$150,000.

**Virginia:**

Albemarle ....50 mi. grading & draining, 20 mi. macadam, 2 mi. concrete.
Augusta ......4 mi. bit. macadam, 1 mi. gravel, 5 mi. waterbound macadam.
Pittsylvania...[illegible] mi. conc., $300,000; 15 mi. soil, $60,000.
Tazewell .....Grading, macadam, bridges (county only).

**Washington:**

Clarke .......7 mi. grading, 3 mi. paving, 255-ft. conc. arch (state).
Ferry .........15 mi. grading and gravel surfacing.
Grays Harbor.10 mi. gravel road, 1 mi. conc. pavement, reconstruct trestle bridges.
Island ........2 mi. grading and graveling.
Jefferson .....1½ mi. grading and gravel, $40,000.
Lewis .........3 steel bridges.
Lincoln .......7 mi. concrete, 20 mi. gravel.
Okanogan .....15 mi. grading (gravel).
Pend Oreille...10 mi. primary, $110,000; 1 mi. permanent heavy, $15,000.
Whatcom .....2.5 mi. conc. permanent 16 ft. wide.
Whitman .....15 mi. grading, including culverts, 5 mi. crushed rock surfacing.

County. Kind and Amount of Work.

**W. Virginia:**

Berkeley .....5.25 mi. waterbound macadam.
Boone .........Grading and drainage, $164,000.
Mineral .......11 mi. plain macadam, 15 mi. grading.
Taylor ........7.67 mi. plain concrete, 9.0 mi. bit. macadam, 40,000 sq. yd. brick.
Upshur .......10 mi. grading, 3½ mi. paving.
Wood .........Cement concrete, gravel & improved earth.

**Wisconsin:**

Adams .......8 mi. gravel surfacing, 10 mi. clay-gravel surfacing.
Ashland ......Grading, surfacing, bridges.
Bayfield ......Reconstruct old roads, repair few bridges.
Florence .....15 mi. grading, 8 mi. surfacing with mine rock and gravel.
Fond du Lac...9 mi. surfacing, 40 mi. gravel & grading, 6.6 mi. conc. surface, 34 mi. paving.
Forest .......Grading, $50,000; bridges, $25,000.
Jackson ......Grading and surfacing.
Jefferson .....46 mi. concrete.
Juneau ........20 mi. grade and gravel.
La Crosse.....Bit. macadam.
Polk ..........Grading and graveling.
Portage ......30 mi. gravel, 6 mi. 18-ft. concrete.
Richland .....12 mi. grading, 12 mi. gravel surfacing, ½ mi. concrete, 3 mi. shale.
Sauk ..........Macadam, grading, bridges & culverts.
Sawyer .......Construction, $61,000; gravel, $30,000; bridges, $5,000.
Shawano .....Grading, culverts, surfacing with gravel.
Sheboygan ...42 mi. gravel, 5 mi. concrete.
Trempealeau..Grading, shale surfacing and gravel, culverts and bridges.
Vernon .......Shale surfacing, $14,000; 66,000 sq. yd. concrete, $12,000; grading, bridges.
Walworth ....18 mi. gravel, 28 mi. concrete.

| | | | |
|---|---|---|---|
| Owen ........ | Maintenance | ...... | 15,000 |
| Rockcastle ...... | Bridges | ...... | 60,000 |
| | Maintenance | ...... | 20,000 |
| Woodford ....... | Plain macadam | 10 mi. | 35,000 |
| **Louisiana:** | | | |
| Beauregard ..... | Bridges | ...... | 5,000 |
| Caddo ......... | Plain macadam | 3 mi. | 36,000 |
| | Uvalde rock asphalt, 2" | 5¾ mi. | 180,000 |
| | Uvalde rock asphalt, cold, 1" | 1¾ | 40,000 |
| | Oil surfacing | 100 mi. | ...... |
| **Michigan:** | | | |
| Cass ........... | Plain macadam | 7 mi. | 110,000 |
| Chippewa ....... | Plain macadam, 16 ft. | 7 mi. | 91,000 |
| Delta .......... | Plain macadam | 5 mi. | 40,000 |
| Kalamazoo ...... | Plain macadam | 14 mi. | 140,000 |
| Luce ........... | Surface treatment | 7 mi. | 9,000 |
| | Maintenance | 60 mi. | 26,000 |
| Muskegon ....... | Plain macadam | 7 mi. | 19,000 |
| Ottawa ......... | Sheet asphalt on crushed stone | 1½ mi. | 48,000 |
| St. Joseph ...... | Plain macadam | 1 mi. | 20,000 |
| **Minnesota:** | | | |
| Big Stone ...... | Culverts, 12" to 72" | 1,783 ft. | 2,830 |
| | Maintenance | ...... | 10,200 |
| Chisago ........ | Reshaping | 45 mi. | 7,000 |
| | Maintenance | 160 mi. | 71,000 |
| Mahnomen ...... | Maintenance | ...... | 7,952 |
| Norman ........ | Bridges and culverts | ...... | 24,000 |
| Pine ........... | Concrete bridges | 6 | 11,363 |
| Red Lake ....... | Bridges and culverts | ...... | 26,811 |
| Stevens ........ | Portable culverts | 2,249 ft. | 4,293 |
| | Reinforced concrete culverts | 104.72 cu. yd. | 2,304 |
| | Bridge, 20' x 20' slab | | 2,283 |
| Swift .......... | Bridges | ...... | 6,300 |
| Wadena ........ | Bridge, 45 ft. truss | ...... | 4,300 |
| Washington .... | Maintenance | 105 mi. | 30,000 |
| **Montana:** | | | |
| Cascade ........ | Sub-grade and drainage | 50 mi. | 18,000 |
| Custer ......... | Culverts | 280 | 16,800 |
| Gallatin ....... | Bridges | ...... | 83,135 |
| Granite ........ | Culverts | ...... | 3,000 |
| Golden Valley ... | Maintenance | ...... | 15,672 |
| Madison ....... | Bridges | ...... | 9,711 |
| Sheridan ....... | Maintenance, roads | ...... | 3,290 |
| | Maintenance, bridges | ...... | 3,075 |
| | Bridges | ...... | 12,241 |
| Treasure ....... | Bridges | ...... | 678 |
| **Nevada:** | | | |
| Esmeralda ...... | Repairs | ...... | 2,000 |
| **New Jersey:** | | | |
| Burlington ...... | Sheet asphalt | 8 mi. | 240,000 |
| | Maintenance | 225 mi. | 75,000 |
| Mercer ......... | { Sheet Asphalt | 21,058 sq.yd. | 3.21 |
| | { Granite block | 5,850 sq.yd. | 5.96 |
| **New York:** | | | |
| Dewitt ......... | Filling washouts | ...... | 5,000 |
| | Plain macadam | ¾ mi. | 3,200 |
| Genesee ....... | Plain macadam | 1½ mi. | 16,300 |
| **North Dakota:** | | | |
| Cass ........... | Maintenance | Earth roads | 25,000 |
| | Bridges | ...... | 60,000 |
| Grant .......... | Bridges | ...... | 30,500 |
| **Ohio:** | | | |
| Allen .......... | Plain macadam | 2 mi. | ...... |
| Ashland ........ | Resurfacing, plain macadam | 5 mi. | 20,000 |
| Clark .......... | Bridges | 2 | 3,242 |
| | Culverts | 15 | 3,032 |
| Fairfield ....... | Maint., gravel and limestone | 213 mi. | 120,000 |
| Hancock ........ | Plain macadam | 150,000 sq. yd. | 160,000 |
| | Stone, repairs | ...... | 100,000 |
| Harrison ....... | Resurfacing, plain macadam | 3 mi. | 12,000 |
| Henry .......... | Plain macadam | 7 mi. | 75,000 |

# Minneapolis Street Maintenance

**Resurfacing oiled streets by scarifying, pulverizing, blading and rolling. Method of operation described in detail.**

Street maintenance in Minneapolis is conducted under a somewhat unusual system, in that there is a street commissioner for each of the thirteen wards. These commissioners are under civil service and so are well protected. Each is independent of the other twelve and in most respects is entirely independent of the city engineering department, although nominally the city engineering department is designated by the city council as the general street commissioner. The director of the Bureau of Municipal Research, F. L. Olson, who has furnished us with most of the information contained in this article, states that so far as he can learn there is no consultation by either the commissioner or the two aldermen of any of the wards with the city engineering department concerning the equipment and methods to be used in street work and the result is that the city is likely to have as many different kinds of equipment as it has wards.

One of the wards, the Second, is operating a new piece of equipment, and Mr. Olson recently inspected the work being done by it. He describes the method of resurfacing a street with the use of this machine, a combined tractor and roller with a scarifier and grader attached, as follows:

The machine was operated from the rear by one man who controlled the scarifier and was able to watch the results of his work because of the location of the driver's seat. There was no grader attached to the machine, but a grader can be hooked on in a minute or two. This gives the driver opportunity to watch the work of both machines. The tractor weighs, as now built, between 8 and 9 tons. It moves along at a good rate of speed and is very successful in scarifying, grading, pulverizing and rolling the soil, despite the oil which tends to break up the dirt in cakes.

In explanation of this last statement, Mr. Olson states that a somewhat similar machine of another make working on another street broke out the pavement in large-sized cakes which were bound together by the oil used by the city for keeping down the dust on its dirt streets; the blade in this case not smoothing out the surface satisfactorily, with the result that traffic produced numerous chuck holes soon after treatment.

In this Second Ward work the plan of operation was to scarify the street first, then have a man blade it for purposes of breaking up the larger cakes of dirt. Next the tractor with a grader attached or separately drawn, as the case may be, again bladed the broken-up surface in order to further pulverize the dirt. The dirt was continually brought toward the center of the street in windrows and this turning-over process, plus the blading and the action of the heavy drum, served to reduce the dirt to very small particles. After the blading, the final action was for the tractor, with the scarifier lifted and without the grader, to roll the street. The last process was the oiling, which varied in amount with the character of the soil and the traffic.

As developed by the latest practice in Minneapolis, the scarifier travels up one side of the street the full length of the work (not more than one-half mile for an eight-hour day) and back the other, scarifying to a depth equal to or slightly greater than the penetration of the oil. The grader is not used on the first cut, but on the second the grader man throws to the right the material loosened by the first and second cuts. This procedure is followed forward and back until the entire road surface has been completely scarified, the material then being laid up in a number of windrows.

The material in the windrows from oiled roads is very lumpy, sometimes in pieces two or three feet square. The machine is then driven on top of these rows with the scarifier raised, the grader throwing the material to the sides, making new windrows. This is continued until the material is thoroughly pulverized, when it is graded back into place to give a uniform, level foundation; after which the road is thoroughly lap-rolled and is then in condition to be re-oiled and sanded.

RESURFACING A MINNEAPOLIS STREET.

"The particular street in question," says Mr. Olson, "was three blocks long, approximately 1,100 feet. The work began at 10 o'clock, an hour was taken off for noon, and all operations up to the point of oiling were completed by 4:30. I did not remain to see the oiling but assume that it would have taken not to exceed an hour of additional time. In this particular case there was one man driving the tractor at a daily wage of $5 and a second man operating the grader. The street

commissioner estimates an expense of $3 per 8-hour day for gasoline, 50c for oil, but has not allowed anything for repairs. The reason for this omission is the lack of necessity for making repairs so far, beyond replacing a few of the teeth in the scarifier. An estimate of five years' life for the machine with a $3-a-day rate of depreciation is charged also. According to the commissioner, it is possible to complete from six to eight blocks per day. Judging from the operation on this one street, I would be inclined to say that six blocks was very near the maximum.

"No accurate accounts are kept, no time or service reports are turned in by the men who operate the machines, therefore most of the figures given are estimates. . . . I urged upon Mr. Ludwig the desirability of keeping accurate reports and accounts of the work done in order that an accurate record of the unit cost might be arrived at. Personally, my impression from this day's observation is that the machine is well worth the investment and that it is doing satisfactory work." The machine used in this work was that known as the "Gray Giant" combination road and street maintainer.

# Lincoln County Road Work by Day Labor

Lincoln County, Washington, does a large part of its road work, including the crushing of gravel, by its own forces and equipment.

During 1922 it operated a plant at Davenport, another near Almira with two crushers, one near Sprague consisting of two crushers, which it rented from Adams County, one near Creston, one near Wilbur and a double crusher near Reardan.

The accompanying table shows the itemized cost during the season of operating each of these plants and utilizing the material so obtained in road improvement, and the average cost per cubic yard in place of the material so turned out and utilized.

The work at the Davenport plant included stripping the pit, crushing, screening, hauling, subgrading and spreading.

The Almira force crushed the entire product to 1-inch and resurfaced five miles of highway; and also, as a separate account, resurfaced the connection through the town of Almira, the cost of $870 being paid by the town. In addition to the items given in the table, this force also spent $3,383 in grading and ditching, which was paid by the state.

At Sprague the entire product was crushed to 1-inch and used on 4.3 miles of state maintenance westward from the town, together with 132 cubic yards placed on a county road. In addition, this gang spent $4,049 in widening shoulders, deepening ditches, etc.

At Odessa, no crusher was used, but a gravel loader and a grizzly was used for handling the gravel, which was used in resurfacing with an average haul of 4 miles.

At Creston there was an extreme haul of 6 miles on one road and work done on three other roads. while 1,445 yards of base rock was wasted.

The Wilbur plant was a poor pit containing an excess of sand and 2,096 cubic yards of sand were wasted. Graveling three miles of new grading, using 6,501 cubic yards of gravel, cost $6,176.

At Reardan three miles of new grade was surfaced, using 4,726 cubic yards and the remaining 304 yards was sold for $312, leaving the net cost of these three miles $4,845. The average haul was 3½ miles. The work was done in sixteen days and nights.

In his report on this work, which was sent to us by J. L. Thayer, construction engineer, he gives also prices by contract work, which can be compared with the force account work above referred to. One highway, 4.2 miles long, near Reardan, completed in 1922, cost for grading and graveling with two-course crushed gravel, 2-inch and 1-inch, $23,165 or $5,516 per mile. The price paid for gravel in place was $1.46.

Near Wilbur 6.52 miles of grading and surfacing with crushed rock, 1-inch and 2-inch, was done at a cost of $35,468 or about $5,460 per mile, the price of crushed rock in place being $1.70. Another contract for three miles of standard 24-foot road, 7% maximum grade, was graded by contract for $4,710. This was graveled by day labor for $6,176, 2,166 cubic yards per mile of crushed gravel being used. Near Reardan another highway three miles long was graded by contract for $5,964, being 24 feet wide with 7% maximum grade. This also was graveled by day labor at a cost of $4,845, using 1,575 cubic yards per mile.

## Sewer Cleaning in Belle Plaine, Iowa

The main outfall sewer at Belle Plaine, Iowa, which, extends several miles from the city proper, at one time became stopped up. After trying different methods of removing the stoppage, a turbine machine was employed. As there were no water mains nearby, water for operating the sewer-cleaning machine was obtained by pumping sewage from the sewer by means of an old fire engine. Among the materials removed by this cleaning was a cement bag filled with sand that had been carried down into the sewer during a previous attempt to clean it.

ROCK CRUSHING AND IMPROVED ROAD WORK IN LINCOLN CO., WASHINGTON, IN 1922, BY DAY LABOR

| Location of plant | Davenport | Almira | Sprague | Odessa | Creston | Wilbur | Reardan | All plants |
|---|---|---|---|---|---|---|---|---|
| Repairs and supplies | $598.18 | $1,919.81 | $319.09 | $239.15 | $999.63 | $902.89 | $393.62 | $5,402.32 |
| Labor | 2,857.35 | 2,963.97 | 1,418.75 | 605.05 | 2,921.33 | 4,696.10 | 2,644.60 | 18,107.15 |
| Gas and oil | 1,915.74 | 1,805.57 | 1,788.34 | 547.45 | 1,291.66 | 2,549.68 | 1,472.60 | 11,371.04 |
| Cook house supplies | 331.39 | 238.29 | ........ | ........ | ........ | ........ | 237.41 | 1,142.82 |
| Tires | 506.12 | 336.34 | 498.80 | ........ | 432.65 | 352.90 | 258.66 | 2,385.47 |
| Rental of equipment | ........ | 300.00 | 893.72 | ........ | ........ | ........ | ........ | 1,193.72 |
| Miscellaneous | 56.37 | 274.37 | 10.47 | ........ | 168.79 | 193.01 | 150.13 | 1,723.14 |
| Work for town | ........ | 870.00 | ........ | ........ | ........ | ........ | ........ | ........ |
| Total cash paid | $6,265.15 | $8,708.35 | $5,294.85 | $1,391.65 | $5,814.06 | $8,694.58 | $5,157.02 | $41,325.66 |
| Work done: | | | | | | | | |
| 2-inch base, cu. yds. | 3,650 | ........ | ........ | ........ | 2,069 | 2,376 | ........ | 8,095 |
| 1-inch fine, cu. yds. | 6,849 | 8,340 | 6,448 | 1,461 | 2,849 | 6,752 | 5,030 | 37,729 |
| Average cost per cu. yd. in place | $0.60 | $1.05 | $0.82 | $0.95 | $1.18 | $0.95 | $1.02 | $0.90 |

# Recent Legal Decisions

### CONTRACT TO KEEP IN REPAIR PAVEMENT INSIDE "TRACKS" CONSTRUED

In an action by a city against a street railway company to recover money paid by the city for repairs to a street for a distance of two feet outside of the rails of the company under an ordinance accepted by the company providing that the company should pave the part of any street through which its railway may be laid that lies inside of the rails and two feet outside thereof, and to keep the parts of the streets *inside of their tracks* at all times *in good repair* the city contended that the words "rails" and "tracks" are not synonymous; that "rails" is limited to the metal which forms part of the "tracks," white "tracks" includes, not only the rails, but the ties, ballast, etc. The Court of Errors and Appeals of New Jersey holds, City of Bayonne v. Public Service Ry. Corporation, 119 Atl. 9, that this may be true when crossing railways, levying taxes, etc., are involved; but in the case at bar the words "inside" and "outside" clearly show that the *tracks* mentioned mean *rails*.

### CONSTRUCTION OF STATE-AID HIGHWAY THROUGH CITY WITHOUT CITY'S CONSENT

The Georgia Supreme Court holds, Lee County v. Mayor of City of Smithville, 115 S. E. 107, that the state, through its Legislature, has as much power and control over the laying out, construction, maintenance and closing of the highways, streets, lanes and alleys of municipal corporations as it has over other public highways. It may change, alter or abolish either class of these highways at will. It may exercise this power directly or may delegate it to municipalities, the counties of the state, or to any other constituted body. It can withdraw the power, in whole or in part, at will. It is the duty of the state to lay out public highways and improve them in cities as well as in unincorporated county districts.

The Legislature has power to establish a state road, and tax the cost and expense thereof upon the county, without the approval of the county. Under Georgia Laws, 1919, p. 242 et seq., providing for a system of state-aid roads, it is held that the State Highways Department, co-operating with the county commissioners, can build a public road through an incorporated town without its consent and against its will.

### COUNTY BOARD MAY ALTER COURSE OF ROAD, THOUGH NEW PART LOCATED ONLY IN ONE TOWN

The Minnesota Supreme Court holds, Nelson v. County Board of Nicollet County, 191 N. W. 913, that the county board had jurisdiction of a petition for the alteration of an existing county road by laying out between two given points therein a new road, thereby straightening and shortening the course of the old road. It was immaterial that the part of the new road thus petitioned for was only in one town. The order establishing such alteration ipso facto vacates the part thereof which lies between the termini of the new part after the lapse of two years as provided by the Minnesota statute.

### STREET SPRINKLING A GOVERNMENTAL FUNCTION—CITY NOT LIABLE FOR NEGLIGENCE OF ITS DRIVER

The Georgia Court of Appeals hold, McCrary v. City of Rome, 115 S. E. 283, that the sprinkling of the streets by a city is an act connected with the maintenance of the public health, and therefor is a governmental function; and the city is not liable for the negligence of one of its employees while actually operating the street sprinklers or water wagon for the purpose of sprinkling the streets. This is true, although the sprinkling is done by the waterworks department of the city, and although that department is operated by the city for gain and profit. The court will take judicial notice of the well-known fact that the dust in the streets of a city is liable to be infested with deleterious germs, and that the winds, or swiftly moving automobiles or street cars, cause the dust and germs to fly about and settle in the eyes, ears, noses and bronchial tubes of persons passing along the streets, causing illness and disease, and that this may be prevented by sprinkling.

### HIGHWAY DISTRICTS AND THEIR SPECIAL COMMISSIONERS NOT LIABLE FOR NEGLIGENCE IN ROAD CONSTRUCTION

The St. Louis Court of Appeals, Missouri, holds, Sharp v. Kurth, 245 S. W. 636, that special road districts are public corporations and quasi public subdivisions of the county and the state, and, in the absence of a statute making them liable for their negligent acts, are not liable for negligence in the building and construction of public works, such as roads and bridges. And the special commissioners of such districts are not liable for their mitsakes of judgment or their acts of negligence in doing work. They can only be held liable individually when their acts are done maliciously and wilfully.

### PAYMENT OF LABORERS' WAGES BY GENERAL CONTRACTORS TO SUBCONTRACTORS RELEASES FORMER

A foreman for subcontractors on highway construction not only knew when cash payment to the subcontractors was made by the general contractors, but acquiesced in the method adopted for payment. The general contractors paid the subcontractors enough to liquidate the labor claims, but the foreman was not paid in full by the latter. In an action against the general contractor, the Arkansas Supreme Court holds, Miller v. Koetzel Bros., 245 S. W. 33, that the foreman had constituted the subcontractors his agent in the collection of his wages, and payment to the subcontractors released the general contractors.